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Space Heating and Air Conditioning

Some New Considerations

IT would probably not be necessary for the electrical industry to win more than 50 per cent. of the total possible space-heating business to bring about a set of conditions under which this one class of load alone would outweigh all others in magnitude. But this prospective space-heating load must be subjected to the most rigorous planning and control if it is not to prove an embarrassment to the industry.

Fortunately electrical men are finding an avenue of approach to the tremendous opportunities offered by continuous space-heating. We cannot subscribe to the view expressed by Mr. Ackery in this issue that electric heating is merely heating. We contend that space-heating by electricity offers advantages over all other forms of space-heating by virtue of its unique flexibility in regard to both installation and control.

These considerations have an important bearing on the comparatively new development of comfort air-conditioning. Unless the keenest attention of electrical men is directed to the problem, the heating load necessarily associated with air conditioning is likely to be diverted to steam, when not only would future business be lost to electricity supply, but the existing space-heating load would very likely also pass to steam in many instances.

But why should this valuable load be allowed to go to steam? To those who suggest that direct electric heating of air for general large-scale diffusion cannot be considered, we point to the two successful heating and ventilating installations already in operation at Bourne & Hollingsworths, London, and at the entertainment hall at Fleetwood. Neither of these installations may be considered as ideal in the light of the physical laws which govern air-conditioning, the finer control associated with which provides infinitely greater scope for the electrical man. The electrical industry is not committed to direct heating to the exclusion of other methods, however, as Mr. Gilchrist shows in his contribution to this issue.

It is largely because of the finer control necessary with electric heat that the cruder methods of heating have taken first place in most of the older systems of heating and ventilation. The principles upon which modern air-conditioning are based, however, call for precision control such as electrical engineers are accustomed to provide.

The central plant is not the only concern of the air-conditioning engineer, however; the later unitary system also demands the attention of the electrical engineer. Because of its flexibility electricity was welcomed as the heating agent of the unitary system. In fact the present stage could hardly have been reached by any other means.

In their general design air-conditioning units have something in common with modern electric convectors, and without a full appreciation of air-conditioning laws there might be a strong temptation to take the easy path to a kind of partial air-conditioning. Mr. Foden shows in this issue that it is only by the precise control of the ever-changing proportions of sensible and latent heat that constant conditions of comfort can be maintained. Obviously, then, with misapplied humidity undesirable air conditions could be easily brought about, with results very damaging to the cause of electric space-heating.

Air-conditioning is automatically bringing in its train an additional and welcome power load by way of fan, pump and refrigerator drives, but lest this prospect of new business should cause supply undertakings and others concerned to overlook the vitally important aspects which we have mentioned, we devote special attention to the subject in this issue.

Air-conditioning experts have helped us to present to our readers a true picture of what is almost a new science, and the articles by electrical men already closely concerned with the new problems will help to avert what could easily be a setback for the space-heating load builder.

Preventing Fires

There is nothing very startling in the report of the Committee which has been investigating methods of preventing fires in generating stations and major sub-stations. Its principal function has been to collate the most advanced engineering opinions on the subject and to bring to the notice of electrical men some excellent notes on fire-fighting equipment prepared by a specialist in this line. The scope of the report did not, of course, include the first essential, which is the suitable design of apparatus for its work, nor the ultimate requirement that the supply shall be resumed without delay even if the fire should get the upper hand. That opens up a bigger question altogether. One thing that goes by the board is the old ideal of keeping the supply going at all costs, as the report recommends that if a fault fails to clear itself automatically the section involved should at once be isolated by hand and that any adjacent sections which are likely to be affected by the fire should be made dead also. The only recommendation that receives emphasis by underlining is that "a comprehensive record should be kept of the results of all inspections and tests," indicating that dependence must still be placed upon the conscientious performance of apparently minor duties.

American Holding Companies

The contest between the President and the American utility holding companies seems at the moment to be going in the former's favour. On Monday last the United States Supreme Court ruled as constitutional the provision of the 1935 Public Utilities Act requiring companies holding more than 10 per cent. of a gas or electricity company's voting stock to register with the Securities and Exchange Commission. This registration subjects them to the Commission's control in the matters of new capital issues, the purchase of new properties and in their relations with their subsidiaries. *The Times* points out that this is a move towards the simplification of the corporate structure of holding companies and the dissolving of those companies whose properties do not form a "geographically and economically integrated system."

Periodical Inspections

Electrical contractors in New South Wales are likely to have more work than they can cope with as a result of the Sydney County Council's decision to proceed with a plan for periodically inspecting the installations of all of its consumers. Where there are defects—and it is believed that 25 per cent. of the installations will need attention—the consumers will be required to have these remedied by licensed electrical contractors. Whereas the contractors stand only to gain, however, the County Council will have to engage nearly sixty additional men as inspectors, and a loss of revenue through consumers being unable or unwilling to meet the cost of the stipulated repairs seems inevitable.

Chartered Electrical Engineers

A high standard of proficiency is required of corporate members of the Institution of Electrical Engineers. They must have had some years of experience in responsible positions in addition to a theoretical and practical training. Moreover, their candidature must be sponsored by those who have already been through the ordeal. These preliminaries are essential if the title "chartered electrical engineer" is to continue to be regarded as the distinction that it is. Nevertheless, we have some sympathy with certain complaints voiced by graduates in our Correspondence section recently. The first is that they may not, owing to the location of their work, come into touch with the two full members and three other corporate members required to sign their nomination forms from personal knowledge; if they lived abroad the signatures of only two corporate members would be necessary. The second grievance is that they may be unable to secure posts for which associate membership is a necessary qualification, since only the holding of such posts would give them the responsible experience requisite for promotion from graduateship. (Incidentally, many employers do not appear to attach enough importance to a graduate's qualifications). The position, however, is probably not so difficult as it appears, and we would refer ambitious young electrical engineers to the hint given by Mr. J. W. Thomas in his chairman's address to the North-Western Centre. A dissatisfied graduate ought to bring his case to the notice of the hon. secretary of his Centre, so that if the local Committee accepts his plea it may authorise its chairman to take the matter up with the Council of the I.E.E., which has expressed its willingness to give special consideration to hard cases.

Automatic Firedamp Detection

A recommendation that the temporary regulations issued in 1935 by the Mines Department shall be continued, subject to amendments, has been made by the Committee on Firedamp Detection Regulations. Its findings are, in brief, that in safety-lamp mines an approved automatic detector should be used in conjunction with every electric motor and that, generally speaking, one detector in eight on a longwall face should be of the automatic type. The Committee is satisfied that a suitable electric alarm is available in combination with an electric lamp that complies with the lighting requirements. The weakness of the present position is the dependence on the human element required for the proper use and maintenance of the appliance, and that would appear to be the reason for the objection of two members of the Committee to making its adoption compulsory until it has been shown to be reliable after a period of service underground. Provided the automatic detector is used and maintained as it ought to be, it should be a valuable contribution towards safety, but much will depend upon the response made by officials and miners to the appeal of the Committee to exercise the reasonable precautions necessary in order to secure the hoped-for results from its recommendations.

Grid Engineering

Although the grid has been a going concern for some years there is still plenty of technical interest in the annual report of the Central Electricity Board, reviewed in this issue. Fifty-five miles of transmission lines and eight switching stations were added last year, while modifications were made to existing plant to secure advantage from recent improvements. Among the developments recorded are circuit-breakers of the impulse type, with little oil, used at Boulder Dam, U.S.A., carrier-current protection and 132-kV cable. Rearmament has held up generating plant extensions (which have to be four years ahead). There is some comfort to be gained from the showing that operating economies due to the grid have more than offset the recent rise in coal prices, which would otherwise have been a heavy tax on consumers.

The Board's Finances

The Central Board made no further issue of stock during the year, and the chairman, Sir Archibald Page, tells us that no more new capital will be required for some years to come. There is still a margin of over £9,000,000 between the amount raised and the maximum of £60,000,000 which the Board may borrow. The balance on revenue account increased by over 19 per cent. to £2,014,508, showing satisfactory progress. This progress is also reflected in the fact that the Board has been able to meet the interest on five of its seven stock issues out of revenue, in advance of its legal obligation; in the case of two stocks this obligation did not operate until the end of 1939. The Board finished the year with a substantial amount in hand to meet future interest and redemption fund charges, which, of course, will rise for some years until the redemption fund contributions and interest payments are being fully met.

Air Conditioning and the Electrical Industry

By E. M. Ackery, B.Sc.

So much is being said to-day about air conditioning that it is worth while considering how it affects the electrical industry. The particular value of the electrical air-conditioning unit, the author points out, lies in the fact that refrigeration in the summer is balanced by heating in the winter, the fan load remaining constant throughout the year. American experience gives some indication of the possibilities of the system

EVEN in this country air conditioning is by no means a new idea. It has been practised for many years in connection with industries where the control of temperature and humidity is essential to the handling of a material or the success of a process. In such cases, however, the air conditioning load has not attracted much attention, and from the point of view of the supply industry it has been simply another power load automatically obtained with the general power load of the works in the case of public supply, or lost with the general supply in the case of private generation. The latest development is not air conditioning itself, but rather the application of air conditioning for the comfort and well-being of people. The term "comfort conditioning" has been coined to describe this new application of an existing science. Whereas industrial air conditioning may be considered a manufacturing process of little general or popular interest, comfort conditioning is a welfare measure that affects almost every one of us and is consequently of the greatest public interest.

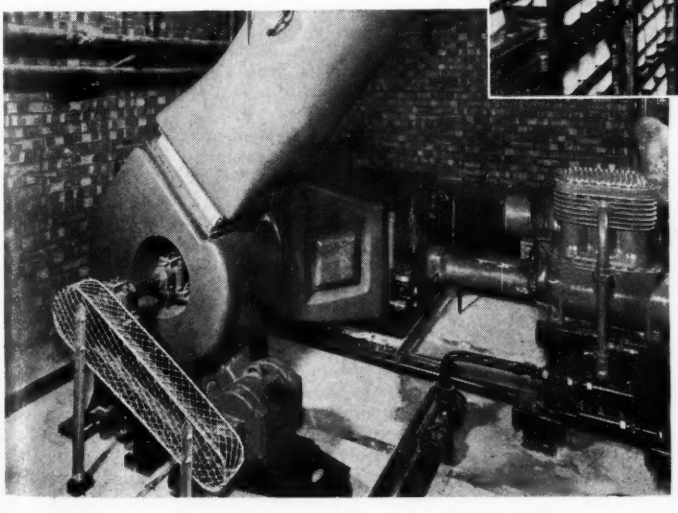
Mr. E. M. Ackery is E.D.A.'s electric heating specialist [*Elec. Rev.* photo.

It should hardly need pointing out that if anything is of general public interest and is remotely connected with electricity it pays the electricity supply section of the industry to "cash in on it." The Electrical Development Association is making strenuous efforts to link up air conditioning with electricity in the minds of the public, and if this effort is backed up by the supply undertakings it should be possible to ensure that air conditioning is regarded as another service that electricity renders to the community.

Because climatic conditions in this country differ so widely from those in the United States it would be unwise to predict that the development of air conditioning in England will follow along the lines of American development, but, for all that, we cannot afford to neglect altogether what has taken place in America. There is good reason to suppose that the total air conditioning load in the United States is close on one million h.p., and is increasing by leaps and bounds. In Chicago air conditioning has created a major problem for the water supply authority, and huge sums of money are being spent on laying new service mains to cope with the ever-increasing demand for cooling water for air conditioning refrigerators. In some districts air conditioning is creating summer peak loads that are not far short of the winter peaks. Even if development over here falls far short of all this, it can still be a development that the supply industry cannot afford to ignore.

American summer temperatures are high and are often accompanied by very high relative humidities, and there was a definite demand for relief from these conditions before there was any equipment on the market to meet it. Consequently, as soon as the service became available there was an immediate response, and development has been phenomenally rapid. It may be assumed that the greater part of this development was for summer "comfort conditioning," that is, cooling and dehumidification, accompanied in many cases by controlled ventilation. As the seasons in America are fairly regular the equipment is only required in summer, and this has given rise to the possibility of summer peak loads. Only very recently has the idea of all-the-year-round conditioning taken root, and this fresh aspect has naturally increased the load-factor value of air conditioning, which, so far as summer conditioning is concerned, is rather poor. Many American electricity supply utilities who frown on the summer conditioning load because of its bad load factor—and there are quite a few who have not welcomed it with open arms—regard all-the-year-round conditioning as a highly desirable load. Incidentally, the use of electricity for heating in America is rare, so that the winter air conditioning load does not include heating.

In the more moderate climate of Great Britain we do not often suffer from intolerable heat, so that the idea of summer cooling in itself has not such a big appeal. There is, however, a very real but rather vague desire for better general conditions in the places where we work and play. People are getting very dissatisfied with just heating in winter and open windows in summer, and what they are really reaching for is all-the-year-round conditioning. It might, with some justice, be claimed that air conditioning will be developed on a basis of freedom from dirt and noise, as these are the most obvious benefits that it brings in its train. We are, however, so accustomed to the existing state of affairs from which we suffer, continuously, if not acutely, that no very striking immediate demand can be expected. The demand is not nearly so insistent as it was in



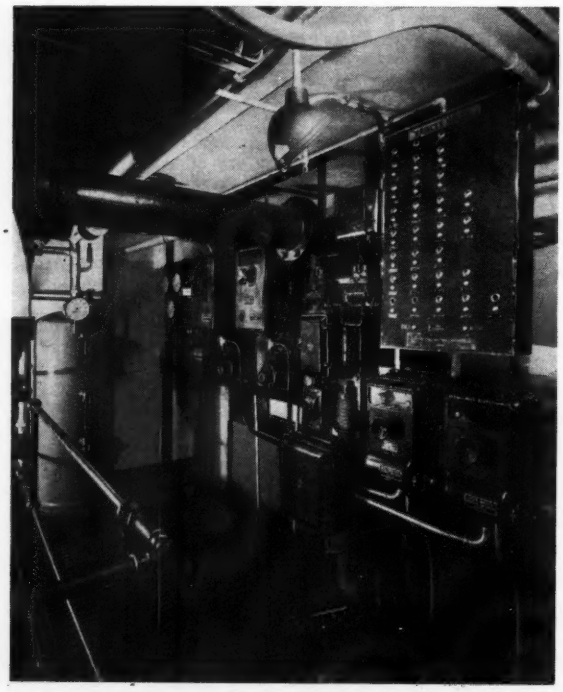
An air-conditioning plant at the White City Club and Restaurant (left) and an industrial-type air-conditioning installation in a Co-operative Society dairy

America and is one that needs particularly active stimulation.

As yet, there is a tendency to regard air conditioning as a desirable luxury, but that is true of all progress. Good lighting and central heating were all considered luxuries, and expensive luxuries at that, in their day. Now they are regarded as essential in both commerce and industry. It is only a matter of time before air conditioning will be regarded as a necessity. The installation in the director's office will be followed by the equipping of the whole of his staff's accommodation. The equipment of the super cinema, the luxury flat, and the high-class shop will be followed by service in more normal buildings and dwellings.

The air conditioning load varies according to the type of building and the equipment used. The self-contained unit air conditioner which has only comparatively recently been put on the British market is steadily gaining ground and over 400 of one particular make have been sold in the course of the past twelve months. The self-contained unit is intended for isolated rooms, but it will also serve a number of rooms in one building where the difficulty of installing a central plant is too great. The load represented by the unit air conditioner is an excellent one, because the refrigerating load in summer is balanced by the heating load in winter, while the fan load is constant throughout the year.

All supply engineers know that the electric space heating load is a difficult one to obtain. Most consumers are prepared to admit that electric heating is better heating, but in spite of that it is still merely heating, and the cost is inevitably compared with that of other methods, with the result that the cases where the use of electricity can be justified are relatively few and far between. When, however, electric heating is replaced by electric air conditioning the consumer receives a



Control panels for a large air-conditioning system

service which cannot be compared with that from an ordinary heating system of any description. He obtains a service that is entirely new, and as a result he is not likely to object to the cost of the heating portion because it is more than that of other methods.

One make of unit air conditioner, suitable for a room of about 4,000 cu. ft. capacity, has a total load of 3 kW made up of an 850-W refrigerating compressor, a 50-W fan, a 350-W immersion heater for humidifying and 1.75 kW of heating elements. The average consumption per hour of the heating period is 1 kWh and of the cooling period 0.75 kWh. In an office the annual consumption would be of the order of 2,500 kWh spread over the whole year.

For a central air conditioning plant such as would be installed in a cinema, restaurant, or block of offices the load is not so easily definable. Where air conditioning is employed in place of heating and artificial ventilation the additional load is that of the refrigerator, and where it is employed in place of heating only the extra load is that of the circulating fans and the spray pumps for the air washer. In the case of large plants the decision to install air conditioning is not likely to affect the question of electric heating, which will have to stand or fall on its own merits.

If the worst case is taken, that is, where the additional load consists only of the refrigerator, it must not be assumed that because there are only a few days in the year that are uncomfortably hot that the refrigerator will only run on those days. Humidity plays an important part and makes the period when the refrigerator is required quite lengthy. In one air-conditioned cinema the refrigerator is used for periods varying from 15 to 25 weeks a year. The load factor of the refrigerator is admittedly low, but it is a load that definitely does not coincide with the heating or lighting peaks and that can consequently be classed as off-peak. In cases where air conditioning replaces heating only the refrigerator load is supplemented by the fan and pump loads, the fans and pumps being in use for the whole period of occupation of the building and thus having an excellent load factor.

Partial Air Conditioning

There is little doubt that the development of air conditioning will bring in its train a very big development in the use of equipment that, although it does not give true air conditioning, does go some way towards this ideal. In larger buildings the use of efficient ventilating plant with air washing equipment that will give humidification in winter and some measure of cooling in summer is likely to increase very rapidly in the near future. Such plants are much cheaper in capital cost than complete air conditioning equipment, and although they have no provision for refrigeration they do provide a valuable fan and pump load for the supply industry.

So far as the unit type of equipment is concerned, there is already a tendency for air circulating fans to be attached to electric heaters, and there are several units on the market that provide the functions of heating, air circulation and humidification. These units, however, do not go far enough, and there is a definite need for a semi-portable apparatus which could, for example, be fitted to the bottom of a sash window or connected to an air-brick through an outer wall to provide a supply of warmed, filtered and humidified fresh air in the room. Such a device could be manufactured at a very reasonable price and, while not attempting to compete with the true unit air conditioner, would meet the long-felt demand for something better than fuggy warmth in the office or home. There is a definite opportunity here for some enterprising manufacturer. Perhaps one of the radio manufacturers who are seeking new markets will take the hint!

Reverse-cycle Refrigeration

It is rather difficult to understand why, with all this development in air conditioning, nothing is heard of reverse cycle refrigeration. It is common knowledge that the refrigerator is a heat pump that functions by taking in heat at a low temperature and discharging it at a higher temperature, and that it is just as easy to use it for heating as it is for cooling. It is only necessary to feel the discharge from a unit air conditioner when it is being used for cooling to realise how much heat is being wasted. The attractive feature of the idea is the very high output of heat in relation to the input of energy. In the unit air conditioner described above the cooling power of the 850-W refrigerator is about 8,000 B.th.u. per hour, which means that if used for heating a heat output of about 8,000 B.th.u. would be obtained for an input of 850 W or 2,900 B.th.u.

The chief drawback to the use of the reverse cycle refrigerator is the capital cost, but in the case of an air conditioning installation the refrigerator is already provided and the cost of arranging for it to be used for winter heating would not be very great. On the credit side would be the omission of the heaters and the fact that electric heating would be obtained for from one-half to one-third of the cost of electric heating by conventional methods.

The possibilities of the development of this very fascinating principle have often been pointed out, but it has been so persistently neglected that one is forced to the conclusion that its offer of something for nothing and its apparent violation of the principle of the conservation of energy are too much for a mistrustful world to swallow. Whether this is true or not it will be a great pity if this means of really cheap electric heating continues to be overlooked.

Some people may be inclined to think that electricity has no competitor in the air conditioning field, but this assumption is very far from the truth. In the unit type of equipment the possibilities of absorption refrigeration must not be overlooked, and so far as the large central plant is concerned the steam-jet vacuum refrigerator is a possible and perhaps even a probable competitor. Even if these non-mechanical methods of refrigeration are excepted there is always the chance that if electricity charges are too high some form of power drive other than electricity will be used for the compressor.

Air Conditioning and Space Heating

By W. Gilchrist, M.I.H.V.E.

[*Elec. Rev.* photo.

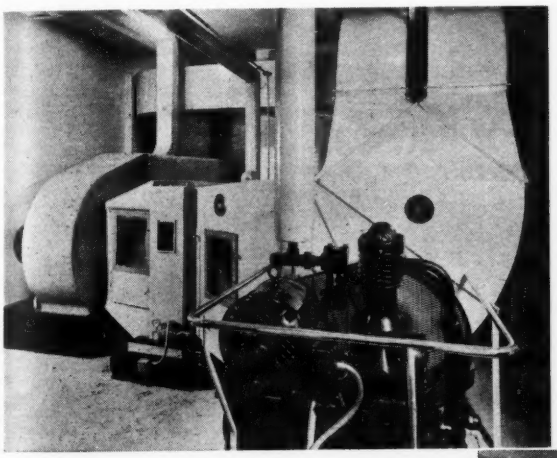
Mr. Gilchrist is Assistant Commercial Manager to Central London Electricity, Ltd.

THE title of this article appears at first sight to be somewhat abstract, but there are certain aspects of present-day development of electrical heating apparatus which have a definite relation to air conditioning. In order to arrive at conclusions we must consider the present design of electric heating apparatus, and in these considerations we will eliminate supplementary heating as being incidental to the problem.

There are at present two clearly defined schools of thought on space heat application, namely, low- or medium-temperature radiant heat and convected heat. The application of low-temperature radiant heat is by means of panels in the ceiling, floor or walls, where comfort conditions are maintained with the minimum of thermal air movement and air temperature rise, while the application of convected heat by means of enclosed low-temperature heaters is designed to maintain an air flow through the enclosure, thus obtaining comfort by warming the air and at the same time inducing a more rapid air movement than by the radiant method. For the average building where there is reasonable manual control of ventilation a combination of both systems is probably the most satisfactory.

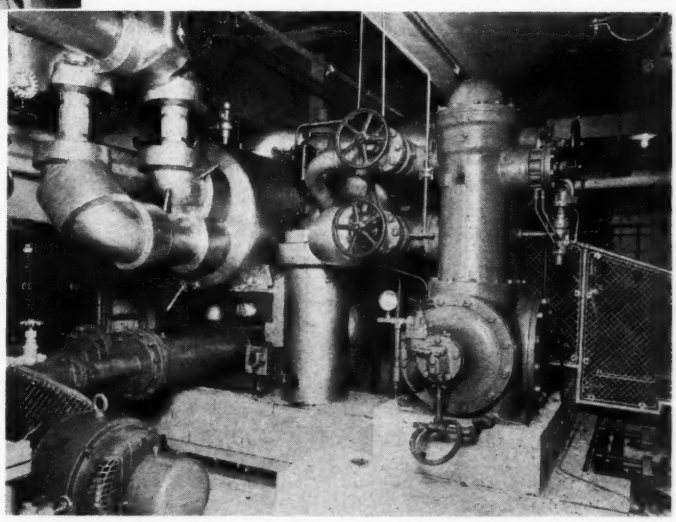
The author suggests the combination of centrally heated air and local thermal storage heating for future air-conditioning installations. Low temperature panels on the outer walls in the form of a continuous band would allow of a much modified system of ducting

The desirability of complete conditioning is becoming increasingly apparent in such premises as restaurants, cinemas and theatres from the point of view of heat gains and humidity, and in offices in congested areas where the elimination of extraneous noise is becoming a necessity. In the main we think of conditioning as using a refrigerant, in terms of summer weather, when even then



under certain conditions some heat may be required; but, obviously, a combined plant incorporating heating and cooling, including, of course, humidification, is the desired end.

How, then, do our present designs of heating meet the requirements? In the cabinet unit conditioner all the comfort requirements are met, but a unit system of this description may not be the ideal installation for new buildings, nor may the



Above: Air-conditioning plant at the new Central London Electricity showrooms. Right: Compressor and cooling plant at Grosvenor House (York Shipley installations)

electric heat application in the unit be the most economical method for either the consumer or the supply company. If the rate of increase of basic space heating is not coincident with the increase of other loads, and if the peak ratio increase of heating with other loads continues as at present, we must look for other methods of applying our medium for this purpose.

In conjunction with the development of air conditioning it is possible to find the proper application, and the following are some suggestions of what may be the lines of future design in respect of the major point under review, which is warming, *i.e.*, winter air conditioning. The essential factor in efficient conditioning, apart from pure mechanics and chemistry, is air distribution. Where a building has low fabric losses in relation to its volume it is possible to maintain comfort-temperature and velocity conditions solely by air distribution, as, for instance, in a basement. In this case the heat can be supplied from a central source to the air supply, either by means of medium-temperature heaters or from a thermal-storage plant. In order to minimise the size of the latter a combination of the two may be incorporated.

Modern superstructures, however, are still further tending to increased window space and low ceilings, the ratio of fabric loss to cube thereby also increasing. It requires a very elaborate and costly system of air distribution to ensure even temperatures, and the addition of low-temperature panels on the outer walls in the form of a continuous band will allow of a much modified system of ducting. It is desirable that these panels should be of a form embodying sufficient heat storage to allow a cut-off period of electricity supply during the heaviest peak periods of the supply company. The air warming would be incorporated in the main conditioning plant, either by thermostatically controlled direct heaters or by thermal-storage plant.

By using a system of this description the incoming air temperature need not be so finely controlled, and one thermostat in the main duct on the return air side would probably be adequate. The panels would be thermostatically controlled, but consideration should be given to group weather aspect control operated by outside thermostats.

A further control would be desirable, worked in conjunction with both heat services, air and panels, whereby the panel heat lag—due to its storage factor—could be assisted by higher air temperatures and *vice versa*. Where thermal-storage plant is the air heat source this should be supplied direct from the electrode boiler between high peak seasons and would ensure a higher overall efficiency of the plant.

The heat losses and air change required must vary with the function of the building, but for an average installation, if the direct heating approximated to half the fabric losses under extreme conditions, it would probably meet the requirements.

While, as I have suggested, the capital cost of a combined installation might be higher than a complete warm-air distribution system, this higher cost would be offset by lower running costs and space saving on ducts and other equipment and would ensure perfect comfort conditions.

It would appear, then, referring back to present design, that there are definite advantages in using low-temperature radiant heating panels in air conditioning rather than convectors. Care must be taken, however, in the application. It has often happened where mechanical ventilation is called for that the electrical engineer has installed ceiling panels and

[*Elec. Rev.* photo.

At the Chartered Insurance Institute, London, panel heaters supplement basic warming from air-conditioning plant

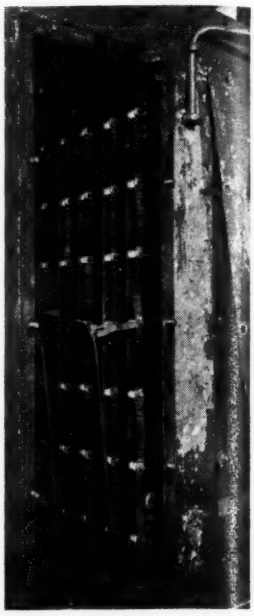
the ventilating engineer has so arranged his air distribution as to blow air across the heated panels, thus extracting the warmed air, with resultant high running costs.

The electrical engineer has admitted that the heating engineer has a better knowledge of the subject, and, conversely, the latter admits that the former can supply the proper equipment. It is apparent that much closer collaboration is required between the electrical industry and the heating industry to ensure satisfactory final results.

The foregoing remarks apply mainly to future developments in buildings where, while air conditioning is desirable, it is not an apparent commercial necessity. It is gradually being established that there is a class of building where it is a commercial necessity, as is evidenced by plants being installed in various theatres, cinemas, restaurants, and operating theatres. The main object of these plants is to dissipate heat gains and excessive humidity due to high light intensities and other factors. The previous method by plenum ventilation obviously necessitated much higher air change. In designing the plant one had to allow for winter warming of this change, entailing much higher heat load, which although perhaps not required under full occupation of the building, nevertheless, required space allocation and capital expenditure on heat plant.

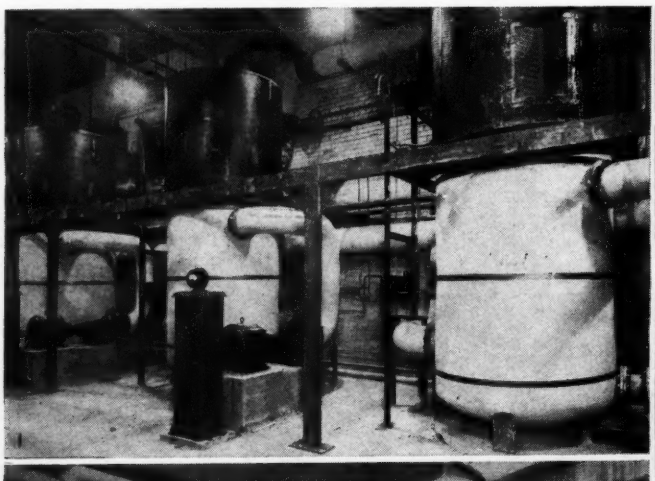
In using complete conditioning plant less fresh air changes have to be heated and the capacity of the heating plant is considerably decreased.

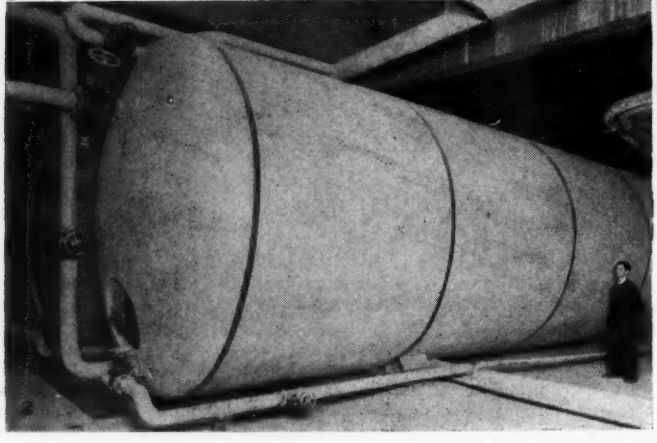
Whereas under a plenum system the excessive heat requirement would be in favour of using the cheapest form of fuel, in using air conditioning, requiring less heating plant, electricity might be economically applied for heating. Further, in using electricity it is possible to so sub-divide the various sections as to ensure even temperatures throughout.

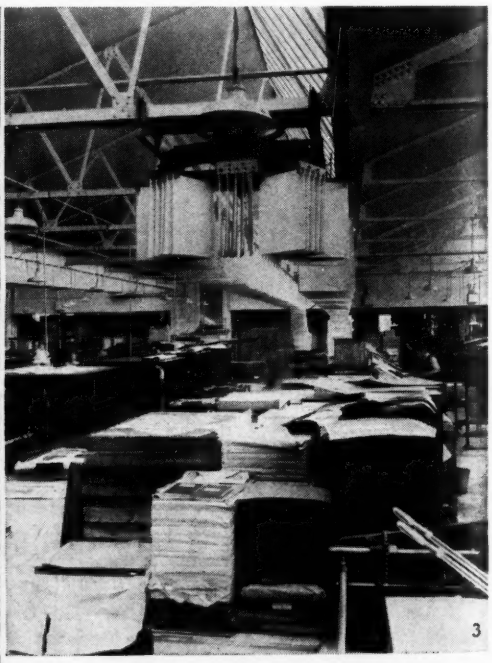


Direct electric heaters in the system at Bourne & Hollingsworth's building, for which Mr. A. H. Barker was responsible

Taking a broad view, therefore, it would appear that for the future the electrical industry can provide electric heating in such a form, *i.e.*, semi-storage panels, as to minimise the capacity of air conditioning plants and air distribution, and, conversely, the application of full air conditioning in (commercial necessity) installations reduces the capacity of heating plants, and in both instances will secure the ideal comfort conditions, which again emphasises the necessity for co-ordinated research into what is a joint problem.







1 and 2. Three 4,000-kW electrode boilers and the thermal-storage tanks at the new Earls Court building. This installation operates in conjunction with a plenum system of heating and ventilation, serving a building volume of 47 million cu. ft. It is estimated that the total consumption for space heating is from 8 to 11 million kWh per annum. 3. Paper treatment in conditioned air on slow-moving conveyor at a new printing works

Air Conditioning for Comfort

By J. E. Foden, B.Sc.(Eng.), A.M.I.Mech.E.

Among the points dealt with by the author is the question of whether a refrigerating unit is needed in this country. Surprising evidence on this controversial subject is contained in the log of a hotel installation which shows that refrigeration was required on as many as 223 days last year—four of which fell in December

THE sensation of comfort is developed very early in the existence of every human being and becomes markedly stronger as life progresses, yet control of the physical properties of the atmosphere, so rarely found to our liking, has waited for attention until comparatively recent times. Progress has been rapid, however, and it is now possible to maintain the air within an enclosure at a satisfactory standard of purity and with a combination of temperature and water-vapour content entirely suited to those persons exposed to it. It is important that the conditions so created shall be automatically controlled and not dependent upon the human element for adjustment, which by the nature of the constantly-varying factors involved is necessarily continuous.

Although the term "air-conditioning" is in ever-increasing everyday use its origin is not well known. It was first coined in the U.S.A. about 1907, the meaning then being confined to the control of the moisture content of air in relation to its effect on hygroscopic materials. Crude plants were installed before the end of last century, but it was not until 1911, when W. H. Carrier read a paper "Rational Psychrometric Formulæ—Their Relation to the Problems of Meteorology and of Air Conditioning" before the American Society of Mechanical Engineers that the scientific principles upon which modern practice in air conditioning is based were laid down.

Mr. J. E. Foden is on the staff of the Carrier Engineering Co., Ltd.

Even in the U.S.A., with its extremes of climate and a people always ready to give new ideas a trial, it was for industrial applications and not primarily for the creation of comfortable conditions that early installations were made. In many instances conditions suited to the material being manufactured or processed were ideal for the workpeople and an increase in their efficiency was noted. This was regarded as merely an incidental advantage, and it was not foreseen that air conditioning for comfort would attain its present important position. It is probably fortunate that early developments took place in the industrial field, as both successes and failures were under the direct observation of technically trained men. Improvements and modifications were made as found necessary, and by the time comfort air conditioning was seen to be a commercial possibility the equipment available and knowledge of the natural laws affecting design were sufficiently advanced to ensure a successful start. Contrary to usual experience, evolution in the case of comfort air conditioning has been from the large installation treating a whole building to the unit equipment, serving the same purpose but scaled down in size and capacity to suffice for a normal room and contained in a casing of moderate dimensions.

The air-conditioned Cumberland Hotel [*Elec. Rev. photo*

A first essential of any air-conditioning plant is that it must be capable of controlling accurately the temperature, humidity, purity and circulation or air within a given enclosure, irrespective of the state of or variations in the outside atmosphere, thereby regulating the effects of such air upon the people and materials exposed to it.

There has been a tendency for the term air conditioning to be applied to equipment of limited performance, and in the United States, where this has been particularly noticeable, the interests of both manufacturer and user have in some measure been protected by the joint action of the American Societies of Heating and Ventilating Engineers and Refrigerating Engineers in drawing up a code standardising the descriptions given to equipment in accordance with their capabilities. A similar code will be found necessary in this country, since, for economic or other reasons, many potential users are unable to acquire full air conditioning yet are able to install equipment which will perform certain of the functions and provide conditions much superior to those prevailing. To these a concise description for each type of plant would operate equally in the interests of the reputable manufacturer by curbing over-optimistic claims and preventing subsequent disappointment.

What combination of temperature and relative humidity ensures comfort? Experience shows that temperatures kept within the limits of 60 and 67 deg. F. in winter, rising to between 70 and 75 deg. F. in summer, with relative humidities of 45 to 60 per cent., are generally acceptable. Of quite equal importance is the control of air movement, as the human body is particularly sensitive to draughts, and it is on this score that most complaints are heard.

After "conditioning" the air has to convey heat to or remove heat from the enclosure being treated, and maintain a satisfactory standard of ventilation by adequate dilution of deleterious gases, smoke and odours through the introduction of a continuous supply of clean fresh air. It is in the inclusion of equipment to control the heat content of the air that the principal difference between the modern air-conditioning installation and the ventilating plant lies. The total heat content of air in any given state is the sum of the sensible and latent heats, the latter being due to the ever-present water vapour, the proportion which each bears to the whole changing continuously in the natural atmosphere.

The development of practical equipment took place simultaneously with theoretical investigation, and for accurate control the water-spray type of air conditioner was found to be the most suitable. It still holds pride of place in the central installation, although other forms have been devised and are used, their selection generally depending upon economic considerations. All types have a common purpose in the adjustment and regulation of the absolute moisture content of the air in accordance with the conditions of comfort it is required to maintain, a process termed "dewpoint control," which with the spray-type conditioner is capable of very close automatic regulation.

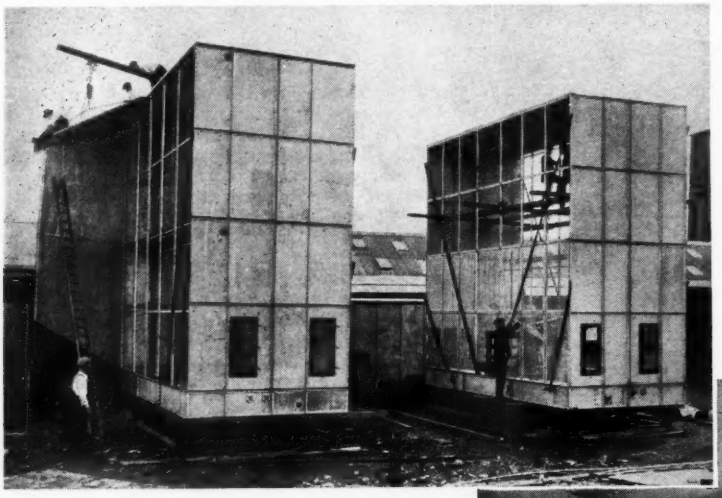
In summer the natural moisture content of the outside air is greater than can be tolerated in comfort, and the excess is precipitated by contact with a finely atomised spray of chilled water, the latter being constantly recirculated and passed through the evaporator of a mechanical refrigerating plant.

In winter the cold, low-moisture-content air from outside is warmed before it enters the spray chamber and rendered capable of evaporating and absorbing a portion of the spray water, or the spray water itself is heated and forms the air-heating medium. All free moisture is removed from the air before it leaves the spray chamber, although it remains

saturated with water vapour. Subsequently it is delivered to the conditioned space in volumes determined by the heat to be supplied or removed before stabilising at the pre-selected dry-bulb temperature. The chief improvements and developments which have taken place during recent years have in the main been concerned with air distribution, automatic control and suitable refrigerants.

Successful air distribution calls for even diffusion without the creation of draughts and is largely a matter of experience. The present trend is to use high-velocity outlets designed to secure rapid mixing of the entering and room air, with a consequent reduction in the temperature gradient. Outlet velocities up to 2,000 ft. per min. in conjunction with an entering air temperature 20 deg. F. below that of the conditioned space have been used with success, and the rectangular grating type of outlet is entirely out of date.

Perhaps next in importance is the subject of automatic control, which is not confined to the regulation of temperature and humidity but is also applied to volumetric adjustment of the air supply to various parts of a building. A complete air-conditioning plant is generally by far the most extensive individual piece of equipment found in the type of



An industrial air-conditioning installation with temperature and humidity control

building where comfort conditioning is the object, and it is essential that the initial and running costs should be kept down to the minimum.

Solar radiation has a considerable influence on both heating and cooling loads, and since the sun traverses from east to west and shines successively on the east, south and west sides of a building in the northern hemisphere, rooms having any one of these aspects will require heating or cooling, according to the season, to a varying extent at different times of the day. The total air capacity of a plant is always determined by the cooling load and it is obvious that if this is taken as the sum of the maximum heat loads in every room, the air supply to those rooms not for the time being subjected to solar radiation will be in excess of requirements, resulting in overcooling unless an artificial head load is applied to make up the deficiency, which is uneconomic.

Automatic control for individual rooms is the ideal solution, but usual practice, involving less expense, is to zone a building, grouping rooms having similar aspects on one control. In this way the total capacity of the installation is reduced to the minimum. A further automatic control has been devised which prevents dampering of the air supply to one zone reacting on the supply to another and causing uncontrolled fluctuations in air flow throughout the system, reproducing the characteristic of the average domestic hot water supply as taps are turned on and off.

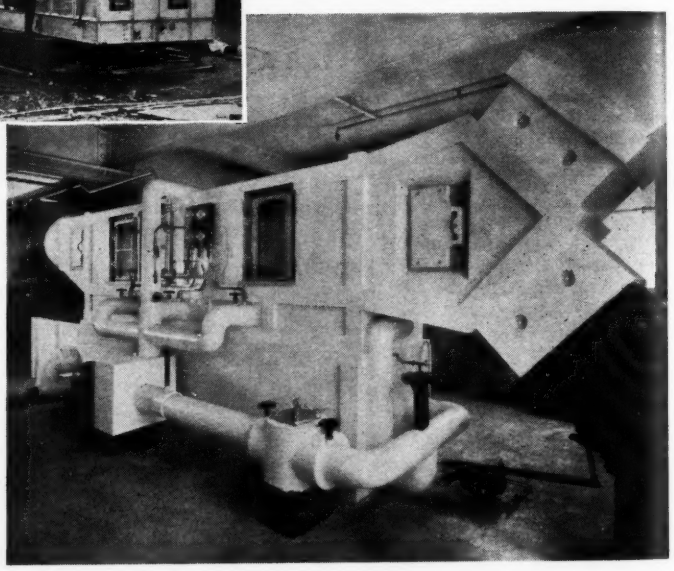
In the field of refrigeration air conditioning, with its special requirements different from those of icemaking and general low-temperature work, has been responsible for the development of new refrigerants and refrigerating plant. It is essential that the former shall be non-toxic and thermo-dynamically efficient, and the latter compact and reliable. Perhaps the most disputed question is whether refrigeration is necessary in this country, and opinions are often expressed without realisation of the facts involved. Table I is taken from the log of an air-conditioning installation in the Cumberland Hotel, London, and shows the number of days in each month on which refrigeration was used. The conditions maintained lie within the limits given earlier in this article and a particularly interesting point is that the average number of days per year for the whole period is well over 50 per cent.

TABLE I.

Year.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total days for year	
1935 ...	2	—	4	8	17	30	31	31	29	16	5	2	175	48%
1936 ...	2	—	17	8	25	29	31	31	27	15	5	8	198	54%
1937 ...	7	7	—	20	30	30	31	31	29	27	7	4	223	61%

Experience with other installations is similar, and in one case where the power-tariff agreement excludes the use of refrigeration between November 1st and March 31st, the limitation has been an embarrassment on several occasions. Our climate is exceedingly uncertain and as we do not respond quickly to changing conditions it is natural that where they exist full advantage is taken of means to ensure comfort. Again, it is found that comfort conditions follow a sliding scale from winter to summer and call for frequent use of the refrigerating equipment. It may also be said that none is so conscious of his comfort as the owner of an air-conditioning plant.

The spray-type air washer or humidifier is actually a low-pressure boiler and device for adding water vapour to the air passing through it. For example, on a typical warm summer's day with wet- and dry-bulb temperatures of 80 and 65 deg. F., respectively, an air washer installation will saturate the air at the latter temperature and increase its water-vapour content from 66.9 to 92.3 grains per lb. Subsequently, heat absorbed by this air in the conditioned space must raise its dry-bulb temperature in order to reduce the relative humidity to within limits imposed by considerations of comfort, as shown in Table II.



Large humidifiers in process of manufacture

TABLE II.

Dry bulb temp., deg. F.	80.0	65.0	78.0	80.5	83.0
Wet bulb temp., deg. F.	65.0	65.0	69.3	70.0	70.7
Saturation temp., deg. F. ...	56.0	65.0	65.0	65.0	65.0
Relative humidity, per cent. ...	44.0	100.0	65.0	60.0	55.0
Total B th.u. per lb. above 0 deg.F.	29.5	29.5	32.9	33.5	34.1
Water-vapour content, grains per lb.	66.9	92.3	92.3	92.3	92.3

The figures in the first column relate to the air in its initial state, those in the second column to the air as it leaves the air washer after adiabatic saturation, and those in the remaining columns to the conditions which may be maintained in the conditioned space, indicating very clearly the limitations of this type of equipment.

In America the importance of air conditioning to the electrical industry has been recognised for several years and the supply undertakings have carefully collected and classified information relating to the installations throughout the country.

Comprehensive Air Conditioning

Studio comfort control in Broadcasting House

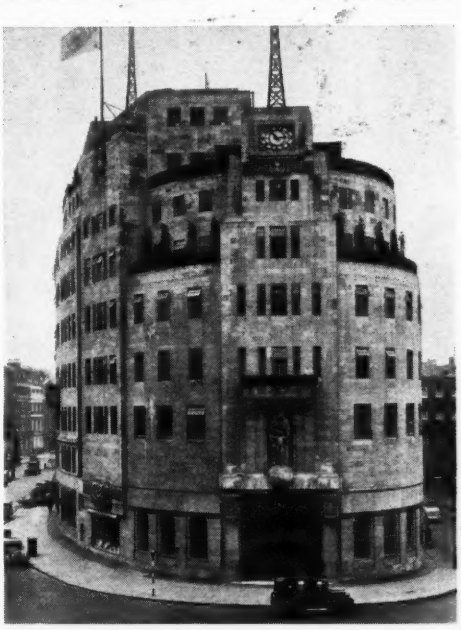
BRIEFLY, Broadcasting House, London, consists of an imposing outer building which acts as a screen to the central tower in which the studios are situated. These studios are entirely dependent on artificial lighting and ventilation, and the importance given to the latter is influenced largely by the fact that their walls are specially treated to prevent the passage of sound. Because the sound insulation is also effective against heat, special attention has also been given to the design of the ventilation system to afford the necessary removal of moisture and heat generated within the studios by the occupants and the lighting.

Air is admitted to the studios through registers concealed in the decorations to avoid interference with the architectural features. The heat and moisture liberated in the studios are removed by the supply of conditioned air which is controlled automatically as to volume, temperature and humidity, the atmospheric conditions so maintained being selected as those most suitable to health and comfort. Owing to the intense illumination employed, the heat released by the lighting makes a very heavy demand on the air-conditioning equipment.

All the studios in the central tower are served by four air-conditioning plants, each comprising a supply fan, spray chambers, pump, heater batteries, automatic controls and an extract fan. Each plant draws its supply of fresh air from the roof through a brick shaft, and also takes a small proportion of return air from the extract fan.

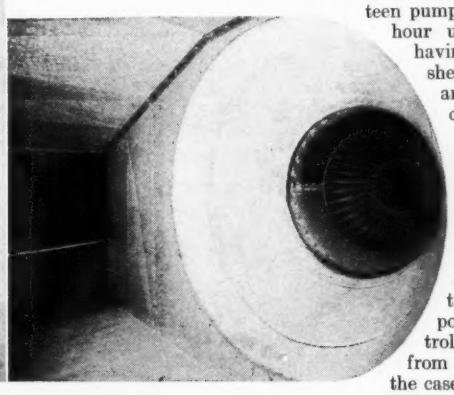
The proportions of the mixture are determined by the setting of the automatically controlled dampers. The air supply is washed free of dirt and soot in the spray chambers, where at the same time the saturation temperature is adjusted. In winter the water content of the air may be raised, but in summer excessive moisture is removed, *i.e.*, the air is dehumidified and cooled by the water sprays.

The supply fan delivers the air which is thus cooled to the studios, steam heater batteries being provided in the ducts to warm the air when necessary before circulation.



[*Elec. Rev.* photo.
Broadcasting House, London

The required conditions of temperature are regulated by thermostats controlling the supply of compressed air for operating the automatic dampers situated in the various trunks and automatic valves controlling the heaters also situated in the trunks leading to the studios. The heaters are served with steam from the main boilers at the reduced pressure of 7 lb. per sq. in.



Left: Humidifying spray chamber of one of the plants. Right: Interior of one of the plants showing the fan

Each plant is driven by three electric motors controlled from one panel whereby each one can be operated separately, or, alternatively, all three can be stopped and started together. The three motors, differing in size, in each plant drive the supply fan, the extract fan and the spray pump. A master control panel is provided so that the attendant can operate each plant from a distance. This panel carries start and stop buttons, indicator lights for each plant, and wet-bulb and dry-bulb distance thermometers which register the conditions of the air in one of the main inlet shafts.

In addition to the four plants serving the studios, there are two similar sets of equipment supplying air to the machine rooms in the basement and certain rooms other than the studios within the central tower; the air for this particular purpose is not artificially cooled in summer, but can be conditioned in winter. There is no recirculation in these cases, the extract fans being situated on the roof. This explains the necessity for remote control of the fan motors from the basement. The total volume of air dealt with by the equipment is of the order of 85,000 cu. ft. per minute.

The water sprayed into the air supply for the studios is cooled in summer to a temperature of 40 deg. F. by refrigerating equipment with a capacity of 200 ice-melting tons, and driven by a 265-h.p. motor. The equipment, which employs step-up gearing, runs normally at a speed of 3,000 r.p.m. The refrigerating machine operates at below atmospheric pressure with a non-poisonous and practically odourless refrigerant. The spray water is pumped from the storage tank through the tubular cooler of the refrigerating machine to the spray tank of the dehumidifiers. It is then returned to the storage tank of the refrigerator by a second pump. In this way a constant supply of cooled water is maintained in the dehumidifying tank and is served to the sprays through the local plant spray pump.

The condenser water is pumped to the top of the building and sprayed in chambers through which a current of air is drawn by means of a fan, so cooling the water before its return to the condenser. This really represents a forced cooling tower. The remaining rooms, mostly offices, in Broadcasting House are heated in the winter by radiators operating on the accelerated indirect hot-water system. The steam is supplied to the heating calorifiers and ventilation plants by two oil-fired water tube boilers of the "Economic" type, each rated at 5,800 lb. per hour evaporation at 50 lb. per sq. in.

The installation employs thirty-two fans, sixteen pumps delivering 641 tons of water per hour under pressure, fifty-four motors having a combined capacity of 504 h.p., sheet-steel ducting weighing 120 tons and sixty independent automatic controls.

The majority of the motors are three-phase 415-V squirrel-cage machines and are served by either star-delta or tapped-transformer starters. The refrigerator motor is a variable-speed machine with a rotor resistance and drum-type controller. There is automatic control (start and stop only) from three positions—one from each master control panel in the sub-basement, one from the actual starter itself, and, in the case of the extract motors on the roof, one from a point immediately adjacent to the machine. In order to prevent transmission of noise of running machinery to the studios the fans, other than those on the roof, are not direct driven, short V-belt transmission being employed in each case. In addition to this precaution all the machinery is mounted on anti-vibration foundations.

To prevent sounds produced in one studio passing along the ventilation ducts to other studios, a special form of sound deadener has been built into the supply and extract ducts for each studio. It is constructed of sound-absorbing material

arranged to form a number of restricted passages in which the sound waves dissipate their energy in friction and so disappear.

Broadcasting House, being devoted to that form of entertainment suitable for transmission by wireless telephony, is distinguished from all other buildings and places of entertainment, such as theatres and public halls. Thus the air-conditioning installation may be considered in some respects as of special design without a bearing on previous practical experience.

The complete air-conditioning plant, including the sound deadening equipment, was supplied by the Carrier Engineering Co., Ltd., in 1931, and has been in constant operation ever since. We are indebted to the British Broadcasting Corporation for permission to publish this description.

Above: The rotary refrigerator serving the whole installation. Left: Part of air-conditioning unit supplying sub-basement and eighth floor studios. Right: Extract fans on roof, showing water coolers in distance

American Air Conditioning Ideas

A RECENT addition to the many semi-technical and semi-descriptive books which have been published in the United States of America in recent years intended to introduce to the reader the fundamental principles underlying the design and selection of air conditioning equipment is "Air Conditioning in Summer and Winter," by R. E. Holmes. (Pp. 296; figs. 118. London: McGraw-Hill. Price 18s.) With the rapid expansion of the industry several of the larger manufacturers have established schools for the technical training of young engineers later to be absorbed in their organisations. Mr. Holmes's book is based on lectures given at one of these schools and sets out to give a comprehensive survey of the subject.

For the reader in this country it contains much matter of interest, but it must be kept in mind that the equipment described has been developed for use in the American climate, which, with its greater extremes and much more clearly defined transitions from one season to another, differs materially from ours. A noteworthy inclusion is the reproduction on page 47 of an advertisement sponsored jointly by the Air Conditioning Manufacturers' Association and Kinetic Chemicals, Inc., and widely distributed to draw the attention of the public to the services legitimately to be expected from equipment complying with the definition of air conditioning approved by the United States Department of Commerce. It is surprising that control of air purity is not included as an essential, but this may, in part, be due to the difficulty of making efficiency tests with simple apparatus. The section of Chapter X, dealing with dust, gives much useful information in small compass, and might with advantage have been expanded to include references to methods of bacterial control.

On pages 25 and 67 are tables of the total heat of dry air, and both are for the range minus 25 deg. F. to 40 deg. F. referred to 0 deg. F. It is not clear whether this repetition is an error, but it would have added to the usefulness of the book had the author substituted in one case an enlarged table giving absolute and specific humidities and the total heat of dry air saturated with moisture, all of which are much more frequently used.

The air conditioning engineer must be well versed in mechanical refrigeration, which has received a greater stimulus from the needs of air conditioning probably than from any other source in the past fifteen years. In the space at his disposal the author has concentrated his attention upon those refrigerants and types of refrigerating plant which appear to be employed by the company with which he is associated. The result, from the point of view of the student, is an incomplete treatment. The opinion he expresses that refrigerants with a pressure cycle below that of the atmosphere have the drawback that inward leaks of air are difficult to detect suggests that he is unfamiliar with the compressors used, as they are fitted with purge pumps and a leak at the shaft seal is very quickly shown up by the vacuum gauge on the evaporator.

At least half the success of the air conditioning installation is dependent upon the air distributing system, including ducts, outlets and automatic controls, and far more time and thought is given to their consideration by an experienced designer than is given to the plant. This section of air conditioning design is dismissed very briefly and the interested reader must look elsewhere for enlightenment.

A publication of this type can hardly be expected to be free from bias favourable to the equipment most familiar to the author, but here the absence of illustrations of representative equipment by more of the prominent manufacturers is to be regretted as they would have increased the interest of the book to readers outside the circle of his own students.

Broadcast on Communications

The B.B.C. National programme last Friday evening included "Lines on the Map," in which a dramatised version of the history of communications from the earliest times was presented. This embraced the story of the laying of the first Atlantic cable in 1858 by the forerunners of the Telegraph Construction & Maintenance Co., Ltd., from the "Niagara" and the "Agamemnon." This cable ceased to operate a few weeks later, and it was not until 1864 that the newly formed Telegraph & Maintenance Co. began the work which resulted in the laying in 1866 of the first really successful transatlantic cable between Valencia and Newfoundland, the "Great Eastern" being equipped as a cable ship for this purpose.

Constructing a Reservoir

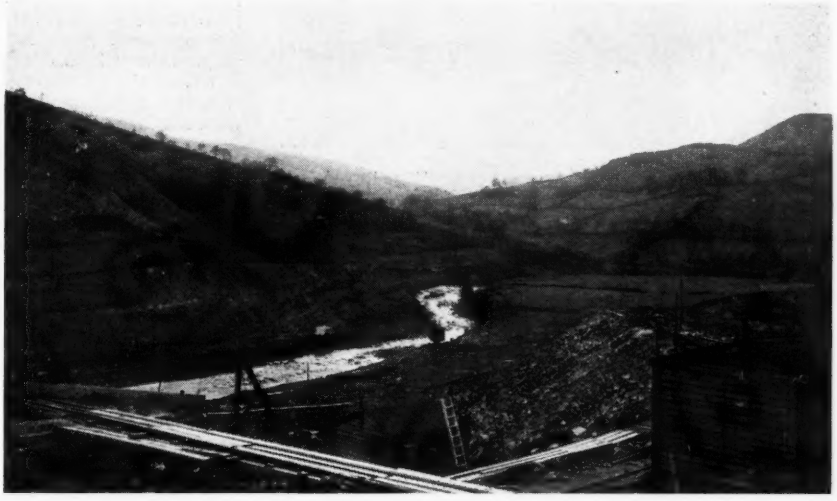
Progress of the Ladybower scheme

Electrical equipment used in large civil engineering schemes has to withstand severe conditions and carry out some unusual duties

SEVERAL large civil engineering construction schemes at present under development in this country are of especial importance to the electrical industry on account of the severe conditions under which the equipment has to operate and the somewhat unusual duties it has to carry out. One of the largest of these schemes is that for the construction of the Ladybower Reservoir for the Derwent Valley Water Board for supplying Sheffield, Leicester, Nottingham and Derby. The contract is in the hands of Richard Baillie, Haddington, and the consulting engineers are G. H. Hill & Sons, Manchester. Work was commenced about two years ago and the scheme will probably be completed three years hence.

The site is in the Derbyshire Peak District, between the villages of Bamford and Ashopton, near Hope. Across the Derwent Valley from Win Hill to Bamford Edge, about 300 yards upstream from Yorkshire Bridge, of tourist fame, a huge earth dam is being constructed. This dam will arrest the flow of the River Derwent, the River Ashop and Ladybower Brook, and thus create an immense reservoir which will submerge 400 acres of land to the north, including the villages of Derwent and Ashopton. With a capacity of 5,500 million gallons, said Mr. A. R. C. Ball (consulting engineers' representative), the reservoir will be the largest of its type (*i.e.*, produced by an artificial earth dam) in the British Isles. The water level will be 663 ft. above O.D.

The dam will be 140 ft. high, 1,300 ft. long and 800 ft. wide at the base. For its construction about a million tons of earth will be required, and also 70,000 tons of clay and 15,000 tons of masonry to prevent erosion by waves. An essential feature of the design is a central concrete wall throughout the entire length of the dam and extending into the hills on either side. The trench to accommodate this has already been excavated and it is 6 ft. wide, 1,300 ft. long and 180 ft. deep on the average.



An up-stream view of the land to be submerged [*Elec. Rev. photo.*

A start has been made on the actual erection of the earth dam by way of disposal of the material excavated from the trench and the trench is now being filled with concrete. Shafts and tunnels to carry discharge and flood waters from the reservoir to the tail bay are under construction, and masonry is being set in the tail bay. The old river bed is being supported on timber for the time being, but the river flow will soon be diverted through one of the tunnels.

Altogether this work is demanding a supply of about 500 kW, and the consumption of the 1,000 or so h.p. of motors engaged in driving aerial ropeways, cranes, pumps, concrete mixers, compressors and crushing plant, together with the lighting, is about 150,000 kWh per month.

Materials are received at the works from an L.M.S. siding at Bamford and conveyed up the old "Paddy Mail" railway which was laid for the construction of an existing reservoir upstream. Sand and stone for the concrete are obtained from the nearby Ladybower quarry which yields about 600 tons per day. The quarry materials are transported to the reservoir site by lorries and delivered to a crushing plant which deals with the 600 tons in 24 hours. The plant crushes, washes and delivers the material for distribution to the concrete mixers as sand and 1¼-in. broken stone.

All the operations are carried out as a continuous process by electric motors with a total capacity of about 200 h.p. Much belt trouble has been eliminated by the adoption of individual drives throughout. There are on this plant five 30-h.p. motors driving crushing units, three 5-h.p. motors driving conveyors, three 5-h.p. drives for elevators and screens, and a 2-h.p. motor serving an elevator for retrieving sand from the washing water.

For conveying the materials from the crushing plant, situated near the Bamford Edge end of the trench, to the three mixing machines spaced along the line of the trench, there is a very large span (1,575 ft.) Blondin aerial ropeway supported by two lattice steel masts, one on each of the Win Hill and Bamford Edge slopes.

This ropeway will carry a 5-ton load at any point between the two masts. It is driven from the Win Hill end by a 110-h.p. B.T.H. reversible variable-speed induction motor served by a tramway-type controller. There is an endless rope for the travel and a single hoisting rope, each with its own winding drum. The Blondin speeds are: Travel, 1,200 ft. per min.; hoist, 300 ft. per min. The one motor drives both drums and drum change-over is provided for by friction clutches. With a rotor voltage of 570, this 400-V Blondin motor is a very low-speed machine, and even so it has a wide speed range—250 r.p.m. to 575 r.p.m. The 250 r.p.m. limit imparts to the rope the crawling speed necessary for inspecting the rope. The driver controls all his operations at the dictation of simple electric bell signals imparted by "Tangent" mining-type equipment. Mr. R. Baillie, Junr., told us that the ropeway operates as smoothly in a Bamford fog as on a sunny day.

From the ropeway skip sand and stone chips are fed into the appropriate feeding hoppers of any of the mixers which deliver the ingredients, *via* a feeding hopper, to the mixer proper. Each mixer will deal with a cu. yd. of mixture in three minutes and is driven by a 20-h.p., s.c. motor served by a star-delta starter. There are six five-ton derricks spaced along the line of the trench and engaged in delivering the concrete from the mixers to the trench bottom. The drop-bottom skips used for this purpose each have a capacity of one cu. yd. Each derrick is driven by a 30-h.p. s.r. motor with a tramway controller. The same derricks were also used for removing material from the trench. The mixers are in telephonic communication with the trench bottom, so that the gangs are in sufficiently close touch to avoid delay. Bell signals are also employed.

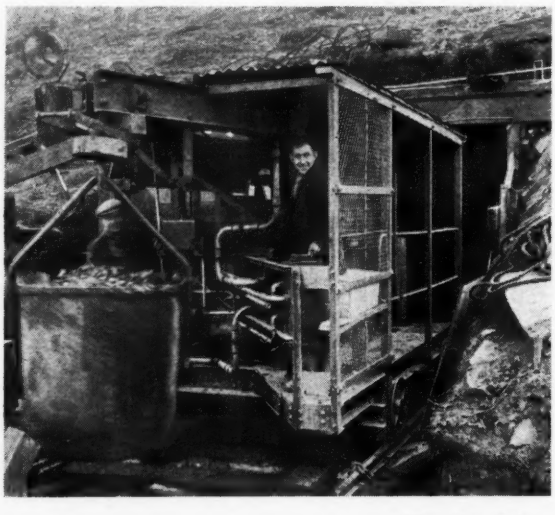
A total of 75,000 tons of concrete will be required to fill the trench, and a rough indication of the rate of progress was afforded by a check on the site—250 skipfuls were delivered on the previous day. For transporting various materials from the workings up inclines to the mixers there are several haulage winders each consisting of a simple winding drum gear driven by a 5-h.p. motor.

Each end of the main trench consists of a wing trench driven into the hillside for a distance of 500 ft. These wings are of tunnel formation, so that the derricks cannot be used for the delivery of materials to and from the trench in the manner described for the main open trench. This difficulty has been overcome by employing two specially designed fixed-jib travelling cranes which run on rails surmounting the trench structure, picking up material at the mouth of the "tunnel" and running it in the tunnel for lowering at the required points.

Sliding-contact pick-ups are employed for the electricity supply, bare conductors bracketed along the side of the tunnel serving for the distribution system. These cranes were specially built for the work by John M. Henderson & Co., Ltd., Aberdeen, to the specification of Richard Baillie, and each equipment measures only 8 ft. 6 in. wide and 9 ft. 6 in. high from the bottom of the rail. The travelling speed is 300 ft. per

minute and lifting speed is 150 per minute. Each crane has only two motors—27 h.p. for lifting and 7 h.p. for travelling, and all the controls are solenoid equipments.

During the excavation period 1¼ million gallons of water had to be removed from the trench each day, and pumping operations to a progressively lesser degree are of vital importance during the filling period. The pumping is effected by three 6-in. Drysdale electrically driven centrifugal self-priming pumps. The contractors spoke enthusiastically about the tremendous advantages of the self-priming pumps, particularly by way of comparison with the steam pump on the score of economy. The pumps are driven by 85-h.p. and 95-h.p. Crypto totally enclosed drip-proof motors controlled by Ellison industrial oil circuit-breakers housed in temporary shelters above



[Elec. Rev. photo.

A special travelling crane at the entrance to a wing trench

the trench. Each motor is slung with its pump in the trench near the water level and to go down the trench by lift to inspect these motors was an experience on a par with that of a visit to a mine.

Each pump is coupled to a pipe-line which has its suction end placed at the end of a length of trench to be concreted, so that two pumps keep this part of the trench free from water during filling operations and while the concrete is setting. A trench length of roughly 60 ft. is dealt with at a time in this way. Flood water will be handled by two 15-ft. bell-mouthed shafts on the reservoir side of the dam which connect with tunnels at the bottom, passing through the trench, so as to discharge water into the tail bay. Each of these flood-water tunnels is about 500 ft. long. A similar arrangement of tunnels will deal with the river supply water, so that the river flow will continue from the tail bay. One of these tunnels is 1,000 ft. long and the other 900 ft.

The two tunnels at each side of the tail bay are disposed one over the other, the upper tunnel being the flood water discharge medium in each case. As already explained the discharge tunnels are to be used for diverting the river when the present river bed is removed to complete the trench and water-seal construction. Materials for the tunnel construction work are lowered down the shafts by 3-ton derricks, each of which is served by a 15-h.p. slip-ring motor with a tramway reversible controller.

Welded Skip Construction

All the skips used are fabricated on site by means of electric welding equipment, one man being constantly employed on such work and welding repairs. He can make a cu. yd. skip in three days. Mandrels for "pulling-up" holes through the trench concrete for cementation work are also constructed in this way. A d.c. resistance-type "Quasi-Arc" equipment is served by an old 230-V Westinghouse shunt machine which has been converted for the purpose by the contractors' electrical staff. Now compounded, it serves the welding unit at 110 V.

We saw another portable welding equipment under construction, this time a 230-V variable-speed shunt motor being used for the purpose. The d.c. welding supply is provided by a crude oil engine which drives, in addition to the generator, an air compressor.

Compressed air required for drilling and other purposes is supplied mainly by a 250-cu. ft. per minute compressor with the 60-h.p. Diesel combined drive just referred to, a 40-h.p. Diesel driven 200-cu. ft. per minute compressor and a 500-cu. ft. per minute compressor driven by a 100-h.p. English Electric motor. A stand-by alternator is available for coupling to the 60-h.p. oil engine in the event of an electricity supply breakdown. "That would furnish us with sufficient current to 'get us out of a hole,'" said Mr. Baillie, "by serving two derricks and sufficient lighting to enable us to retrieve the pumps from the trench."

Self-contained portable electric saws have been put to good use in cutting the huge quantities of timber for shoring the trench. With a ¾ h.p. motor drive for the saw wheel these saws will cut through a 3-in. plank easily. A repair shop on site houses the welding plant and various modern lathes and tools—all electrically driven.

The Power Supply

The Yorkshire Electric Power Company's 30,000-V transmission line to Hope passes under the shoulder of Bamford Edge, and this has been tapped to afford the supply to the workings *via* a 500-kVA outdoor sub-station. From this sub-station underground cable conveys the 400-V, 3-phase supply to a control cabin where electricity is purchased by the contractor. From the control cabin, which is on the down-stream flank of the dam, a main 0.4-sq. in. 3-phase line is extended right across the valley to the foot of Win Hill. This main distributor is continued up Win Hill to the Blondin drive by 0.15-sq. in. cables and is tapped at various points for supplies to a smaller Blondin ropeway which traverses the tail bay, and also the pump and crane feeds. The cable feeds to the cranes are taken between the guy legs, so that the jib cannot foul the lines.

At a point midway along the main distributor a 75-kVA B.I. condenser is installed for power factor correction, and a power factor of about 0.85 is maintained. From this condenser point supply to the heavy-current users, *i.e.*, the mixers and the compressor plant, is distributed. The crushing plant is supplied direct from the control cabin. Except for the pump drives, all the motors employed throughout the workings are of ordinary industrial types, each gallantly carrying on its work continuously under a temporary roof of some description.

Lighting Arrangements

To permit 24-hour working the scenes of greatest activity are floodlighted at night by 500-W Wardle, Revo & Verity projectors supplied by the Needham Eng. Co., Sheffield. The crushing plant provides an outstanding example of this flood-lighting, and 3,000-W illumination projected on this equipment permits efficient working.

As a safety measure 50 V only is employed for the lighting in the trenches and tunnels and is supplied by small 3-phase to single-phase transformer units secured to the trench structures. Sign lamps are used in these positions because they stand up so well to the rough use to which they are subjected.

Floodlight projectors employed in the quarry are suspended from pulleys so that they can be lowered and disconnected from their plugs during blasting operations. They are supplied from two small 230-V d.c. generators driven by a 10-h.p. Petter crude-oil engine.

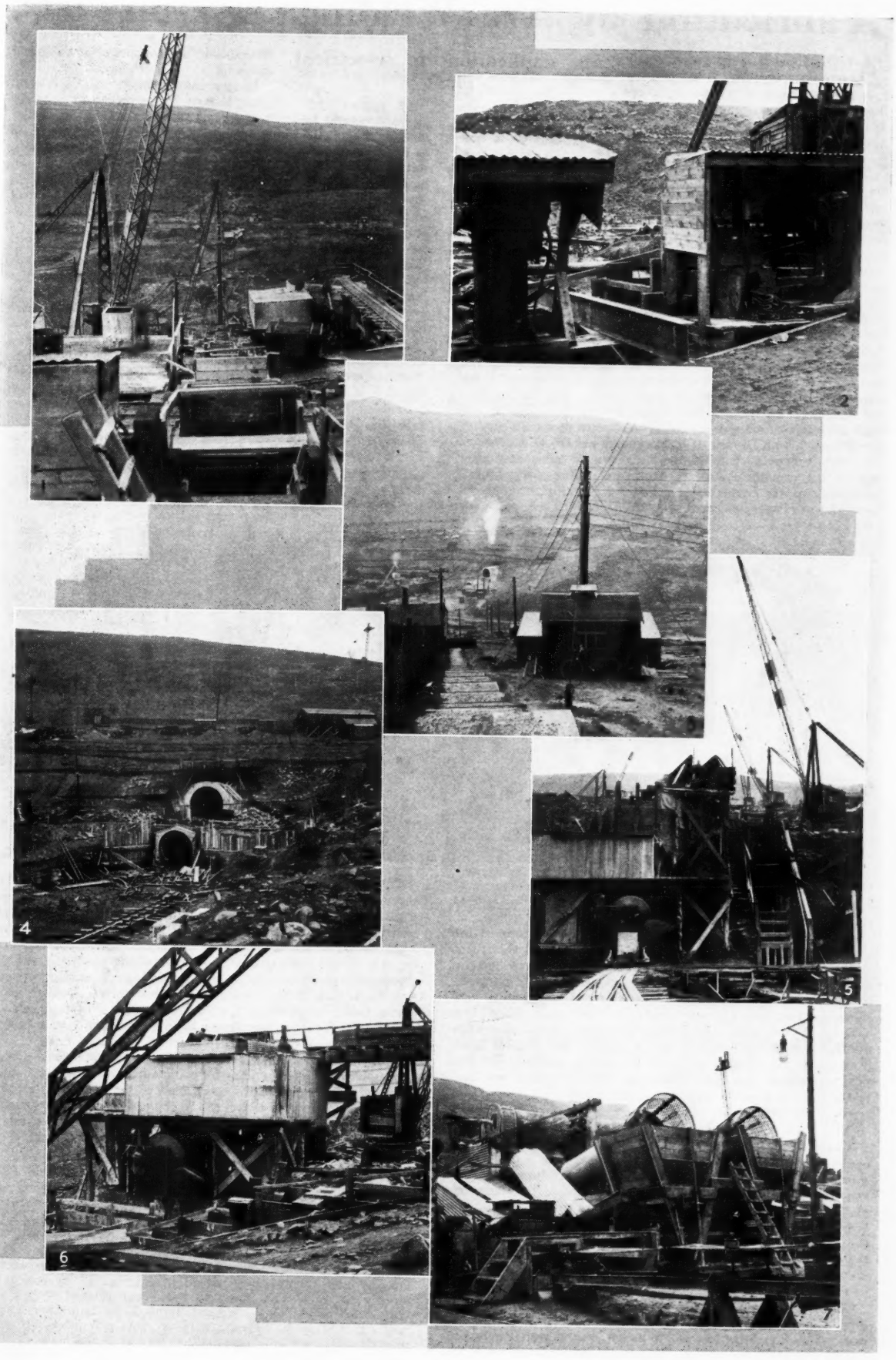
We are indebted to Mr. Baillie and Mr. Ball for their help in collecting the above information and in taking the photographs and to Messrs. Richard Baillie for permission to view the workings.

The Electrical Situation in Italy

(*From an Italian Correspondent.*)

IT is considered that the prospects of the Italian electrical industry are far brighter than a year ago. The consumption of electricity during the first ten months of 1937 rose by 7 per cent. to 12,288 million kWh, and at the end of November the capital invested in the industry (1,711 companies) had reached a total of 10,469 million lire (£113 million).

Besides the construction of large hydro-electric plants, major works now in progress include extensive railway electrification. This year the following lines will be complete: Milan-Piacenza-Bologna (219 km.), Bologna-Ancona-Rome (501 km.), Leghorn-Grosseto-Rome (316 km.), Chiasso-Milan-Voghera (116 km.), and Domodossola-Milan (125 km.). At present there are about 500 km. of trolley-bus services in Italy, and many towns are considering the employment of such a system in place of petrol and Diesel buses. As to prospects, the building of new factories in Turin (tools), Savona (chemical products), Milan (rubber) and Venice (cellulose), together with important industrial developments in Bolzano are likely to increase electricity consumption considerably, and it is doubtful whether present plans for plant construction will be sufficient. It is not concealed that any further construction beyond that in hand would require further investment of money which could not wholly be obtained in Italy. It was reported some months ago that an understanding was contemplated with manufacturers of machinery in Germany, but nothing further has transpired in this matter. It is also suggested that Sweden might be interested in Italian electrical development through the supply of the machinery required for the construction of the new plants.



[*Elec. Rev.* photos.

Constructional Plant at the Ladybower Reservoir. **(See preceding pages)**

1. The trench line from Bamford ridge. 2. Trench pump control switches at the surface. 3. Control cabin for the main distribution cables. 4. Flood water and discharge tunnels under the shoulder of Win Hill. 5. Looking from the valley to Bamford Edge at the trench derricks and mixing plant. 6. A large mixing plant. 7. The 600-ton per day crusher

Fabrication by Arc Welding.

By E. Dacre Lacy

Its application to electrical plant

ALTHOUGH it is recognised in the engineering industry that electric arc welding is producing exceptional results in the construction of machines, there is undoubtedly justification for the view that the wide field in which this process may be applied is not nearly sufficiently well known outside.

There are four types of arc-welding machines, *viz.*, for a.c. or d.c. supplies, motor generator sets with drooping or level characteristic generators; for a.c. only, static transformer sets, engine sets of the petrol or Diesel types and welding generators for belt drive. All these types can be sub-divided into single or multi-operator, portable and stationary equipment. A works manager intending to purchase electric arc-welding equipment should confer with one or other of the more prominent manufacturers regarding the most suitable type for his class of work.

A rapidly increasing demand for the application of electric arc welding to the many various specification metals has forced manufacturers to place on the market a wide range of electrodes for welding all kinds of ferrous and non-ferrous metals. In brief, electrodes for arc welding can be divided into three classes: (1) Bare wire, these need hardly any description, as experience has proved that welding with bare wire is not very satisfactory when mechanical properties of a high quality are required. (2) Dipped or light covered electrodes; these are an improvement on bare electrodes and give sufficiently good results for certain classes of work. (3) Flux-covered electrodes; these are coated with a material of substantial thickness and solidity calculated to provide good protection; they travel well and can be handled without loss and damage, and for jobs requiring high tensile strengths and a good finish, they are preferable to the other types.

The use of electric arc welding has extended more in the electrical industry than in other, owing to the fact that firms engaged in the manufacture of electrical plant have been in closer touch with welding developments than other engineering concerns. In the electric motor branch welding is considerably used. Yokes are made of steel plate rolled into cylindrical form and welded; bars are welded along the inside for the purpose of carrying the iron core, and feet of angle iron and stiffening ribs complete the yokes. Frames for vertical alternators and rotor cages are also welded, as are bedplates for all types of motors or generators.

A Number of Advantages

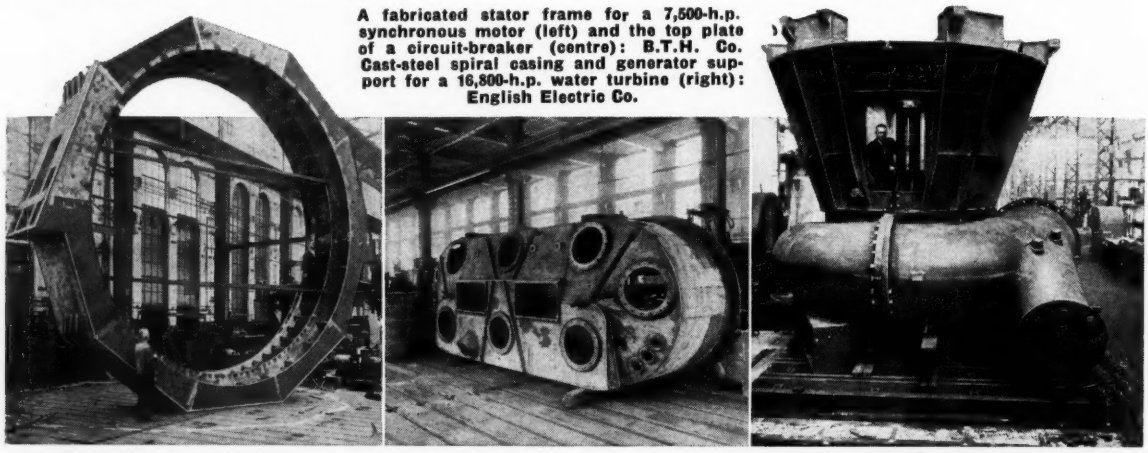
No patterns are required and, where fresh designs are being made, loss of time is eliminated. Comparative figures from a number of different works show that the average saving in weight between a welded and a cast-iron bed-plate is approximately 15 per cent. for small sizes and up to 25 per cent. for large sizes. Rigidity can be obtained without having to add heavy masses of metal. The discreet use of gussets and stiffeners welded firmly in the correct place will produce as rigid a structure as any casting can give with the minimum amount of metal.

The welded-steel bed-plate is very much less liable to damage than a cast-iron type. This is more particularly the case where the bed-plate is for use with a portable plant, or where it may have to be sent for considerable distances before erection. Another example of welded work carried out is in the construction of condensers, and repairs can be more satisfactorily carried out by welding should pitting occur. The greater elasticity of mild steel will also prevent cracking of the casing which is occasionally met with in castings of this description, due to uneven heating and stressing.

It is even possible to machine component parts before assembly in order to avoid setting up large masses of metal on planing and other machines, and therefore arrange work in the machine shop to the best advantage. This is of considerable importance in workshops handling a large proportion of heavy work, it being no uncommon sight to see a large casting occupying the largest machine in the shop merely to machine a small setting and, of course, handling charges are reduced considerably by adopting the more modern methods.

Some Examples

The stator frame for a 7,500-h.p. synchronous motor illustrated is made in halves and measures 26 ft. high by 30 ft. across the supporting feet of the frame, and is 20 ft. in the bore with a total weight of about 35 tons. The steel rotor is also made in halves, consisting of heavy steel discs welded to the rim, weighing 24 tons and measuring 16 ft. in diameter. The base-plate construction consists of heavy beams welded together in pairs, making four sections in all, measuring when assembled 30 ft. by 18 ft., and weighing 24 tons. It is claimed that this motor is the largest of its kind ever manufactured in this country, and is now in service in the works of the Tata Iron & Steel Company, Ltd., driving a rolling mill. Its construction was completed in two weeks from receipt of the order. The total weight of the machine is 160 tons, that of the fabricated parts being over 90 tons.



A fabricated stator frame for a 7,500-h.p. synchronous motor (left) and the top plate of a circuit-breaker (centre): B.T.H. Co. Cast-steel spiral casing and generator support for a 16,800-h.p. water turbine (right): English Electric Co.

The domed top plate of the circuit-breaker, shown, has a large proportion of its surface cut away to accommodate the bushings and centre box, which have to be set and tack-welded into position, making due allowance for the settling down of the weakened dome during welding. All machining operations are carried out in the detail parts before welding, and in consequence the setting of the parts and the actual welding operation have to be conducted along predetermined lines to give the accuracy required in the finished piece. This top plate is about 5 ft. 8 in. in diameter and on completion has to withstand a test pressure of 200 lb. per sq. in. for 30 min.

Two cast-steel spiral casings with generator supports of the type illustrated were supplied for water turbines of 16,800 b.h.p. each. The entrance to the spiral casing is 4 ft. 6 in. diameter, and the casings were tested to 370 lb. per sq. in. The branch pipe shown in the foreground is for connecting up to a relief valve of 28 in. diameter.

Markings for Switchboards

The British Standard Specification for the marking of switchboards issued in 1924 has now been completely revised and reissued. The new edition makes provision for the marking of auxiliary wiring as well as for main conductors, while the colouring and marking for d.c. and a.c. systems has been clarified by being segregated instead of interleaved as was previously the case. The diagrams have been altered to line up with B.S.S. 108-1933 (Graphical Symbols for Electrical Engineering) and those indicating phase and pole markings are reproduced in colour. The method for the preparation of diagrams has been considerably extended to indicate the relative positions of apparatus, particularly where two or more pieces of apparatus are fixed in the same place, one behind the other. Copies of the new specification (No. 158-1938) can be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 3s. 6d. (3s. 8d. post free).

The Progress of the Grid

The Central Board's tenth report

THE annual report of the Central Electricity Board (Whitehead Morris, Ltd., 1s.) for the year ended December 31st, 1937, marks the Board's first decade. During the year the output of public supply stations was 22,905 million kWh. This figure is 2,684 million in excess of that for 1936 and is the highest increase yet recorded for any year. In other principal industrial countries, the output expanded more rapidly in the first nine months, but fell below the British rate thereafter. The increase in 1937 over 1929 was about 123 per cent. here compared with 45 per cent. in the rest of the world.

Most of the improvement has been due to activity in iron, steel, engineering, shipbuilding and automobile construction and in a wide range of lighter manufacturing industries, chiefly serving the home market. There has been a decline in the building of houses by private enterprise, but an increase in the development of housing estates by local authorities and in the construction of new factories (mainly for rearmament) and public buildings.

The erection of large blocks of residential flats, especially in the provinces, has materially increased the amount of electricity sold for domestic purposes. Potential markets for electricity are the trading estates at Team Valley in Durham, Treforest in South Wales, and Hillington near Glasgow.

The Board was able to place at the disposal of supply undertakings and large industrial consumers its experience of standards of consumption, load conditions and comparative operating costs in a variety of industries, thus helping them to secure many consumers.

The whole of the grid system was operated as one unit on twenty-one occasions in 1937

At the end of 1937 the grid system comprised 4,180 miles of transmission lines (2,938 miles of which is operated at 132 kV and the remainder at 66 kV and lower voltages), and 297 switching and transforming stations with an aggregate transformer capacity of 9,695,000 kVA (an increase of 220,200 kVA). New works brought into commission included 132-kV lines from Ironbridge to Stoke-on-Trent, from the Peterborough-Lincoln line to Bourne and from the Wimbledon-Woking line to Leatherhead and 132-kV sub-stations at Bourne and Leatherhead. A 66-kV line from Carlisle to Egremont was completed for initial operation at 33 kV.

Other 33-kV lines were constructed between Spondon and Derby, Coventry and Hinckley and Basingstoke and Alton—the last for the Mid-Southern Utility Co. for 11-kV working at present. Further 132-kV lines are nearly completed with a view to giving increased supplies to Kettering U.D.C. for the steel works of Stewarts and Lloyds and to connecting Upper Boat (Pontypridd) with the Ebbw Vale U.D.C. for the new steel works of Richard Thomas & Co.

A 132-kV sub-station is being erected at Chester, which will be connected to the 132-kV line under construction from Runcorn through the Wirral Peninsula to Birkenhead in order to provide the North Wales Power Co. with substantially greater supplies, partly for the Shotton Iron Works (John Summers & Co.). Further supplies were made available to the Southern Railway at Leatherhead and Reading and an increased supply at Three Bridges. Cables were laid from Islington to Finchley (66 kV) and from Wimbledon to Kingston (33 kV) among others. Preliminary work has been put in hand for running 132-kV lines from the new station at Littlebrook *via* Northfleet to Hastings, from Brighton to Worthing and from the Portishead-Cardiff link to Lydney.

Selected Stations

At the close of the year the number of selected stations remained unchanged at 137 with an installed capacity of 7,653,570 kW. There were also thirty-five non-selected stations under the control of the Board. The Board's programme (arranged in previous years) provided for 779,000 kW of new generating plant and boilers of 7,954,500 lb. per hr. being brought into commission by the December peak, but owing to delays caused by rearmament requirements only 368,000 kW and 4,739,500 lb. per hr. of boilers were forthcoming. During December the totals were brought up to 557,000 kW and 5,349,500 lb. per hr. in boiler capacity.

The additions included a 75,000-kW turbo-alternator in the Barking station, 50,000-kW sets at Deptford West, Clarence Dock and Dalmarnock, one of 33,000-kW at Brimsdown and 30,000-kW sets at Yoker, Thornhill, Kirkstall, Neepsend, Hull, Spondon, Croydon, Brighton and Norwich.

For meeting the load of 1939-40 and in part for the following two years, the Board issued directions last year for the installation of 646,250 kW of generating plant and 7,488,500 lb. of boilers. Among these was the 100,000-kW turbo-alternator for Battersea station, which includes a h.p. cylinder operating at 1,350 lb. per sq. in. and its associated 550,000 lb. boiler. The Hams Hall extension, to be ready for service in 1941, is to be in a new building 900 yd. from the existing one; the initial installation will be a 50,000-kW turbo-alternator with a 3,500-kW direct-coupled auxiliary alternator, three 350,000 lb. boilers and a 5 million gal. per hr. cooling tower. Particulars of plant in twenty other stations are set out in an appendix to the report.

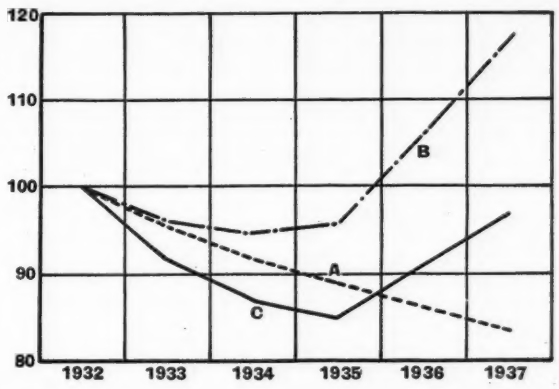
Standardisation of frequency was so nearly completed that the amount payable by the Board can be stated as about £16 million, or £300,000 less than the estimate made seven years ago, although the quantity of plant concerned has increased substantially. It has involved changing over 903,725 kW of generating plant, 100,700 motors aggregating 1,840,968 h.p. and 354,633 kW of converting plant, all of which was done with hardly any interruption of consumers' processes.

In collaboration with the E.R.A. and the N.P.L., the Board has conducted field tests with portable surge generators and oscillographs to ascertain the transient voltages encountered by transformer windings when surges are applied at different points along a 132-V line and to determine means for by-passing such surges to earth. Lightning surges are also being investigated and it is anticipated that the best types of protective equipment will be established within the next eighteen months. Two arc-supression coils installed on the 33-kV Rotherham-Doncaster line and at Bourne (Lincs) have proved effective, and similar coils are to be installed at Hartshead and Stockport.

Research by British manufacturers at their short-circuit testing stations has resulted in an increase in the rupturing capacity of the original 132-kV breakers through modification of contacts, insulators and operating mechanisms. A new type of 132-kV breaker of high speed and rupturing capacity has been ordered for Lydney and Littlebrook.

An improved type of apparatus has been designed for testing insulators whilst in service; of 40,000 insulators so tested in 1937, only about 200 had deteriorated. Protective covering is being considered for aluminium conductors at three places where corrosion has occurred due to exceptional atmospheric conditions; otherwise no undue deterioration is taking place.

A British 32-kV nitrogen-filled cable was put into use in December and successfully carried loads up to 45,000 kVA. High-speed protective equipment installed on new lines has operated correctly. A new carrier-current system of protection having the advantages of pilot protection without special pilot



The effect of rising coal prices on production costs
A. Average fuel consumption per kWh sent out. B. Average cost per ton of fuel delivered. C. Average fuel cost per kWh sent out.

cables is to be used experimentally on the Ribble-Southport 132-kV line.

General trading by the Board was in progress throughout the country except in N.E. England and N. Scotland. Tariffs for the different areas are given in an appendix. In the trading areas 550 undertakings distributed electricity; 203 of these were supplied directly and 293 indirectly from the grid, accounting for 97.4 per cent. of the electricity purchased from public sources.

Disposition of load or an insufficiency of spare plant, the report states, has sometimes precluded transfers of overhead

charges large enough to provide savings to the owners of selected stations who have had to rely upon Section 13 of the 1926 Act, which guarantees that the cost of electricity required for their undertakings shall not exceed what would have been the cost with independent operation. Except in one case the Board and owners have been able to agree upon the costs. All additional costs due to exports to the grid are borne by the Board, which will also be responsible for expenditure due to earlier replacement of plant (if any) arising out of operating conditions, thus securing station owners against loss.

On twenty-one occasions of two or three hours each the grid in the nine scheme areas worked as one interconnected system, dealing, on one occasion, with a load of 4,854,000 kW on the 144 Board-controlled and 43 other stations. A capital saving of nearly £17 million (more than half the expenditure on the grid) is estimated to have been made by the reduction in reserve generating plant due to the grid. The second major saving effected is in fuel consumption, which was 17 per cent. less per kWh than in 1932 under independent operation. At the price level of two years ago this would have meant a saving of about £1,800,000, but owing to the subsequent rise in the price of coal the average fuel cost per kWh was only 3 per cent below the 1932 figure. Only twenty-one of the stations ran for the full 8,760 hours and fifteen of these supplied over half of the total kWh generated.

The Financial Side

The Board is empowered to borrow £60,000,000. Seven issues of stock totalling £53,500,000 have been made prior to 1937 and at the end of that year the outstanding amount was £52,793,003. The proceeds of the stock were £50,672,500, leaving a further sum of £9,327,500 cash, which may be raised under the Board's existing borrowing powers. The issues have been made to the extent of £36,725,000 for the Board's general purposes and to £16,775,000 for standardisation of frequency; the latter amount and the service upon it are recoverable from the Electricity Commissioners. Sinking funds have been set up for the first three issues and the amount has been invested.

The expenditure upon capital account during the year was as follows:—General purposes, £1,833,489, making a total to December 31st, 1937, of £38,233,762; frequency standardisation, £271,994, making a total of £16,944,197.

The revenue accruing from the sale of electricity amounted to £29,659,187. The net cost of this was £26,255,424, leaving a balance of £3,443,763. To this is added rents receivable (£13,228) and transmission expenses (£916,961, including cost of energy used in transmission £372,210), rates, and management and general expenses are deducted, leaving a net revenue of £2,014,508 (which compares with £1,686,944 for 1936). The addition of £1,149,614 brought forward, with unemployment grants (£48,586) gives a total of £3,509,107 on general purposes account. A net amount of £1,212,644 is paid as interest and £535,032 represents redemption fund instalments and interest, leaving a balance of £1,761,431 which is carried forward and will be available, together with future income, to meet the interest and redemption fund charges, increasing year by year for some years, which will fall to be paid out of revenue.

On the frequency standardisation side of the net revenue account the credit is £902,822, of which £712,985 was contributed by the Electricity Commissioners. This was absorbed by interest on stock, £652,759, and redemption fund instalments and interest, £250,063. At the close of the year the redemption fund balance stood at £1,467,783. No stock was redeemed during the year; the amount redeemed prior to the period was £743,054.

As the revenue account records the effect of the Board's trading in all areas, including North-East England, the account shows for the first time the whole of the purchases and sales of electricity and of the Board's expenses of operation, maintenance, management and distribution. It is anticipated that general trading in the N.E. England area will commence by the beginning of next year.

The Board is empowered to pay interest out of capital for a limited period in respect of each stock. Actually for 1937 interest was paid by the Board out of revenue on five issues, in four cases in advance of its obligation.

Fire Risks at Power Stations

Report of the Commissioners' Committee

THE Committee appointed by the Electricity Commissioners in March, 1936, to consider steps to be taken to prevent fire in generating stations and main substations has issued its report (Stationery Office, 6d.). A preliminary memorandum was issued (ELECTRICAL REVIEW, August 21st, 1936) based upon the report of the Chief Engineering Inspector of the Electricity Commissioners (ELECTRICAL REVIEW, July 3rd, 1936) on the Bradford breakdown in 1936.

Under the heading of switchgear attention is drawn to the need for division into sections interconnected by circuit-breakers and separated by fire-resisting partitions or housed in different buildings. Individual sections should not normally control more than 60,000 kVA of generating or transforming plant (or more than the largest unit) together with a corresponding feeder capacity, the feeders to be connected so as to maintain essential supplies with any section out of commission. Current loading per circuit-breaker or bus-bar should not exceed 2,000 A.

Control or operating bus-bars should be separated from electrically operated switches by screening. Fuses for circuits to individual switches must be in the screened area. Bus-bar protection should be connected only to indicating gear until experience has shown that it would not cause inadvertent tripping. When cables pass through a switchroom floor methods must be adopted to prevent drainage of oil and the slipping of the cables, if burned off, into the basement. Cables should be clamped immediately below, as well as above, floor level; in addition to a kerb round the cable at floor level a pipe of heat-resisting material, sealed at the bottom and filled with sand or pebbles, should rise at least 18 in. above floor level or terminate just below the cable gland.

It is advisable to remove jute serving from cables in switchrooms, basements and tunnels, or else to cover the jute with a 10 to 1 mixture of sand and cement 2 or 3 in. thick. Main cables connected to bus-bar sections should be separated by fire-resisting partitions. Existing cables resting on the floor of tunnels or basements should be separated into groups by vertical barriers of tile, brick or concrete and the trenches so formed should be filled with small pebbles (not sand). Control cables should be similarly divided and should follow a different route, if possible.

Apparatus, other than switchgear, that is liable to explosion should be segregated in separate buildings, or in fire-resisting sections entered only from the open air. Roof lights of wired glass and other windows of plain glass are recommended. For the time being it is suggested that for the relief of pressure the combined area of doors and windows should be one-third of the total area of the walls.

Every switchroom, transformer room and the larger fire-resisting sections should have two sterilised-wood or sheet-metal covered self-closing doors, preferably opening outwards. A sill is necessary between sections of a minimum height of 6 in. and capable of holding all the oil in each section. Where barrier walls of full height cannot be placed between transformers, each transformer should be surrounded by a sill.

Oil drains from each switch and transformer cubicle should pass to pits filled with 1-in. to 2-in. pebbles. The dished floors should have a slope to the drain of 1 in 100 as a minimum but 1 in 30 where possible. Brick fire-resisting partitions should be at least 9-in. thick, preferably reinforced.

Opinion among supply engineers is against over-voltage testing as a routine, but there is evidence that such tests have brought to light serious incipient defects. Periodical testing under skilled supervision of parts of switchgear not included in the zone of automatic protective devices is considered desirable at intervals of about six months. Over-voltage tests are preferably carried out with an a.c. voltage not less than 1.6 times the r.m.s. value. Where, due to the capacity of associated connections, an a.c. test is impracticable, d.c. can be used at a voltage not less than 2.7 times the r.m.s. value.

In the event of a fire the local fire brigade should be called immediately. Neither respirators nor self-contained breathing apparatus should be used except by men trained in their use. Oil fires may best be dealt with either by emulsion-forming water jets or (indoors) by CO_2 apparatus, provided that in the latter case risk of reignition is adequately covered, and also by portable hand extinguishers, sand pails and hoses for the manual application of foam or water sprays. Cable basements and tunnels of limited cubic capacity may be protected by CO_2 apparatus when effectively sealed from the outside atmosphere or else by ordinary water sprinklers.

The members of the Committee were Messrs. J. M. Kennedy (chairman), C. G. Morley New, H. Nimmo and A. N. East, of the Electricity Commission, Messrs. Johnstone Wright and J. Hacking, of the Central Electricity Board, with Mr. H. A. Ratcliff representing the Incorporated Association of Electric Power Companies and Mr. F. Forrest the Incorporated Municipal Electrical Association. Major F. W. Jackson, of the London Fire Brigade, co-operated in the preparation of an appendix dealing with fire-fighting equipment.

Meetings and Discussions

Chemists, physicists and engineers contributed to the discussion on the paper on the electrical insulating properties of plastic materials read at the I.E.E. last week. The Wireless Section of the I.E.E. heard a paper on Wednesday dealing with the construction and operation of valves for radio transmission with ratings as high as 150 kW. The appearance of the Central Board's report (see page 465) adds interest to the paper read by Mr. H. S. Davidson at an E.P.E.A. meeting last week on grid maintenance.

Plastics for Insulation

THE electrical insulating properties of plastic moulding materials, as reviewed in the N.P.L. paper by Messrs. L. Hartshorn, N. J. L. Megson and E. Rushton, to which reference was made last week, were discussed at the joint meeting of the Institution of Electrical Engineers and the Plastics Group of the Society of Chemical Industry in London on March 24th.

Mr. H. Langwell, chairman of the Plastics Group, commenced by expressing, as a chemist, appreciation of the opportunity of collaborating with engineers and physicists because the subject bristled with problems, and a chemist must know what engineers required before he could tell them what he had to offer. By stepping in between, the research worker might be able to enlighten both. The value of hydrocarbons was that they were inactive (non-polar) and caused very little power loss. The chemist was now beginning to understand how to make hydrocarbon polymers. They were much the same as paraffin waxes, but had vastly different properties. For instance, polystyrene could be employed for making certain articles very cheaply at the rate of several hundreds per hour. To employ fused quartz for the same purpose would cost several hundred pounds. Few things were so little affected by water, and if some substance of this sort could be obtained in the liquid form for use as an impregnator it would be extremely useful.

Mr. A. R. Dunton said that his experience of the manufacture of condenser bushings confirmed the authors' explanation of the manner in which water was held in spaces within resin. If the substance were protected by pigmented material moisture would be kept out. The statement that there was no direct connection between power factor and breakdown voltage was disturbing. Polystyrene had a very low power factor and was glasslike, but it tended to crack and form fissures. A liquid was now being used for transformers in place of oil to reduce the fire risk. If some such liquid could be moulded the finished product should also be fireproof.

Water Absorption

Mr. H. V. Potter confirmed the authors' description of the difference between the crystalline state and plasticity. Alcohol contained water, and it was, therefore, unwise to use it as a solvent for test pieces. The authors blamed polar groups for many things, including the absorption of moisture, but urea substances which contained no water had none of these polar groups, neither had paraffin wax. A different complexion was put upon the subject of water absorption by the commercial method of manufacture at high temperature and high pressure.

Mr. G. H. Gardner was glad to know that research might possibly enable them to predetermine the properties of materials used for making high-voltage bushings. A low power factor and a reasonable dielectric constant were more important than breakdown voltage, since they determined performance in service.

Mr. R. I. Martin objected to the term "plastics" because the final condition of the material was by no means plastic. He would prefer "moulded composite" because, like the terms "forged steel" and "cast iron," it indicated the process through which the material had passed. It was a pity that the authors had made tests with thin films because, in practice, films were always used in association with something else. It would have been better to employ pieces of larger bulk, of sizes similar to those of finished articles. The authors' tests dealt with what happened under the surface, whereas, in practice, surface conditions were frequently of more importance.

Dr. L. A. Jordan suggested that there was more chemistry in insulating materials than was generally appreciated. The great problem of resin chemistry was to avoid the formation of a porous molecular structure, the reason for which might be likened to log-jamming when floating tree trunks down a river. The significance of this condition was that it prevented the materials from becoming as strong mechanically as they might do. The authors might bear in mind that mechanical strength and desirable electrical properties seemed to go together.

Dr. Willis Jackson said he was sorry that the authors had made little reference to the root of dielectric loss, meaning the underlying physical mechanism. What was the nature of the forces which were brought into play during the orientation of the molecular structure? If the authors had employed a wider range of frequency for their experiments they might have obtained different results. It was very necessary for physical and mechanical properties to be studied along with the electrical properties.

Mr. W. J. Brown said that water could not be blamed for causing a high power factor. He suggested that phenolic compounds were the real cause. The different methods employed for manufacturing condenser bushings and insulating sheets showed that hot vapours were formed which were prevented from escaping. They could be reduced to a fine feathery crystal state and liquefied again by heat. Any substance which would not produce vapours during polymerisation would be of immense benefit. Tests should be made at frequencies at which the substance would be used in practice.

Dr. A. E. W. Austen said that the authors' table of electric strengths would be of little use without specifications of the actual conditions under which the materials referred to had been made.

The Example of Amber

Dr. J. O. Cutter pointed out that amber was the oldest form of resin known. Its age was very uncertain, but it contained less water than any other class. Could similar results be obtained by "ageing" modern materials?

Mr. W. E. Patman questioned whether all resins, however made, had the same constitution. He considered that the vapours referred to by Mr. Brown were actually water vapour. If they could devise some heat-hardening reaction which avoided the production of water vapour, many of their problems would be solved.

Mr. E. B. Moullin referred to work which was being done at Oxford and to the possibility of using silica gel as a filler. This might be beneficial if it enabled the moisture to be collected in the form of small spheres, because in this form moisture was not so harmful as in the form of threads.

Dr. L. Hartshorn, in reply, said that the reason for the cracking and crazing of polystyrene was not known. Someone had described this material as being in a state of chronic strain and full of molecular blow holes. The weights and atomic densities of these materials showed without doubt that molecular pockets must exist. His method of representing water absorption was probably unfair, but he believed that research workers must be ruthless. Nevertheless, he hoped that no one would thereby be prejudiced against any of these materials. The force which caused the internal vibration of these substances was not yet known. It was not analogous to viscosity, but more like solid friction. Some of the so-called unique materials might be found to be not so unique if they were examined over a sufficiently wide range of frequencies, *i.e.*, above and below the electro-technical part of the frequency spectrum.

Sir George Lee, president, in moving a vote of thanks to the authors, remarked that not very much had been said about the mechanical stability of these substances. This form of instability had caused communication engineers a great deal of trouble.

High Power Radio Valves

THE construction, testing and operation of large-capacity thermionic valves for radio transmitting stations are described in the paper by Messrs. J. Bell, J. W. Davies and B. S. Gosling (M. O. Valve Co. and G.E.C. Research Laboratories) that was read before the Wireless Section of the Institution of Electrical Engineers in London on March 30th.

So far as the principles governing constructional design are concerned, differential expansion frequently appears to be a controlling factor. The bulbs are made of lead-potash-soda glass and the anodes of thick copper tubing; for glass-to-metal seals nickel-iron alloy is preferred, but copper is sometimes used.

Insulating members have been eliminated from the active part of the valve and grids are not cross-braced; grid seals include a large ring section let into the bulb and there is an 8-lead multiple seal for pentodes. A description is given of seals for 1,000 A for supporting the whole cathode system,

the evolution of which into a free-hanging multiple form is outlined.

More recent work seems to suggest that a forced air blast might be substituted for the normal water cooling of anodes, but the surface of heat transfer would have to be enlarged by the addition of radial fins, or the equivalent. By this means the anode temperature can be kept down to 140 deg. C., which is a quite usual value for water cooling, with which the rate of heat transfer may be of the very high order of 1 kW per sq. in.

One of the most interesting sections of the paper deals with modern methods of evacuating valves and the correct interpretation of tests. For instance, technique in this respect has proved to be governed by two effects. First, the lower readings of "backlash" grid current obtained in "gas tests" are not directly due to gas but, as the authors have shown experimentally, to photo-electric emission caused by soft X-rays from the anode. Secondly, a properly developed exhaust schedule will produce valves with large and very clean metal surfaces in such a condition as to form most effective pumps, capable of cleaning up surprisingly large quantities of free gas.

A method is described of determining the operating filament voltage for a standard emission by extrapolation to full emission from a reduced emission test. The authors ascribe former variations to variable thermal emissivity and not to variable dimensions; they also show how to extrapolate low power space-current readings into the operating region.

Typical valve-life and performance data illustrate the exceedingly high standard of reliability demanded of transmitting valves. The overall average life of cooled-anode types increased from 4,700 hours in 1932 to 6,400 hours in 1936. Filament burn-out is the only really fundamental cause of failure; it may be delayed, but cannot be prevented. The operating temperature of the filament is 2,500 deg. F. and gradual wastage by evaporation causes failure when the diameter is reduced by 10 per cent. This rule holds whatever the initial diameter of the filament. A 5 per cent. rise in voltage increases the emission by 50 per cent. but reduces the life to one-half.

Multi-filament valves apparently last as long as the equivalent number of smaller ones, when the behaviour of all the limbs is very nearly equal. Valves of the high-μ triode type have been made to dissipate up to 150 kW with 20,000 V (d.c.) on the anode, the filament taking 660 A at 31.5 V and giving an emission of 150 A.

Grid Maintenance

At the last meeting of the session of the London Technical Group of the Electrical Power Engineers' Association on March 22nd Mr. H. S. Davidson gave an indication of the work involved, and of the difficulties and experiences encountered, in maintaining the plant and apparatus of the Central Electricity Board in the Central England district of 7,311 square miles, containing a population of 5¼ millions and including the areas of supply of forty-nine authorised undertakings.

After outlining the routine internal inspection of 132-kV circuit-breakers, the author pointed out that they were operated by solenoid mechanism and auxiliary switches contained in a pillar alongside. In the early stages a good deal of trouble was experienced in these pillars, due to condensation occurring when rapid changes of atmospheric temperature took place. The insides of the covers and doors were coated with cork paint, but the troubles were not fully overcome until each pillar was heated by a carbon lamp. These condensation troubles were a frequent cause of low insulation resistance on the d.c. control wiring. During six years' operation there had only been three cases of major damage to the 132-kV switchgear out of a total of eight-two oil circuit-breakers installed in this area.

Primary transformers varied from 60,000 to 15,000 kVA, three-phase, with on-load tap-changing equipment, and the greater portion of the maintenance work carried out was in connection with this equipment. Mr. Davidson said he did not wish to imply that tap-changing gear was unreliable, but it was the fact that transformers without such equipment called for little attention. All manufacturers had not, at the time these transformers were made, realised that access to such parts as selector switches would be desirable. In later designs these difficulties had been overcome; the divertor switches in every case were housed in separate compartments and access was consequently easier. In some cases carbonisation of the oil took place so rapidly that it had to be changed at intervals of three to four weeks. Troubles with transformers had so far been confined to mechanical and electrical faults in selector and divertor switches, and damage caused by lightning strokes. Only three cases had occurred in which it had been necessary for main transformers to be returned to the makers' works for repairs.

In a sub-station such as that at Hams Hall there were no fewer than 306 post insulators, thirty tension insulator strings and seventy suspension insulator strings working at 132 kV, whereas in the smallest type of sub-station there were ninety post insulators and twenty-eight tension insulator strings. In industrial districts where atmospheric pollution was excessive the maintenance of the insulators was somewhat difficult.

Consideration had recently been given to the washing of insulators by jets of water without making the insulators dead, and experiments had been carried out at the Hams Hall sub-station as a result of which a permanent plant had been installed for this purpose. It was necessary that the water used for washing live insulators should have a specific resistivity of not less than 2,000 ohms/cm.^{3} and also that the jets should be of such a size as to ensure that the stream of water was broken before it struck the insulators. The sizes of jets to be used were determined during the experiments, and as a further precaution the operator used rubber gloves and the nozzle of the hose was connected to earth. It was stated that the speed with which insulator cleaning could be carried out by this method, as compared with manual cleaning, more than justified its adoption.

Oil Cleaning Plant

Each primary sub-station was provided with a permanent installation for oil treatment and all oil circuit-breakers and transformers are connected to a system of clean and dirty oil pipes, storage tanks and pumps. Approximately 4,500 gallons of clean oil was always available on the site and tests were made at intervals of six months on all oil in use or in the storage tanks, portable testing equipment being used for this purpose.

The 132-kV overhead transmission conductors were of steel cored aluminium. The 2,400 towers were fabricated from copper-bearing steel, the final protection being obtained by painting. The use of this type of steel by the Central Electricity Board was confined to the Central England district, all other districts having galvanised towers. Painting the towers involved making the transmission line dead for longer periods than any other operation. The majority of the towers had now been in service for over five years and extensive three-coat painting commenced last year. The small percentage of copper in the steel had a remarkable effect in retarding corrosion and it was hoped that when original troubles due to mill scale had been overcome, after a complete three-coat treatment it would only be necessary to give the towers a single coat of paint at intervals of, say, three years.

The number of occasions when it was necessary to provide additional ground clearance in order to allow buildings to be erected under the lines was becoming increasingly frequent. It usually sufficed to change the existing tower for one fitted with an extension, and the work entailed dismantling the existing tower and re-erecting it on the extension.

Considerable trouble had been experienced on the Continent, and some also in this country, due to breakages of the aluminium strands of steel cored conductors at the clamping points, caused by vibration. Therefore, a minimum of one damper of the Stockbridge type was installed on each conductor and earth wire in every span.

Testing on Live Lines

To carry out voltage-drop tests of all joints and clamps in the overhead transmission lines with the lines alive under load conditions a millivolt meter was fixed on a piece of hard wood with a hook at each end and a long bamboo pole at the centre. The meter was connected to the hooks, which were made to fit the conductor being tested, and the instrument was so arranged that the scale and deflection could be read from the ground by binoculars. It was also proposed to test insulators under live conditions in the near future by measuring the potential drop across each unit in the string, abnormally low potential drop indicating the faulty units. (Suitable apparatus and full details of the method were described by Mr. J .S. Forrest in the Electrical Review of December 25th, 1936).

Many miles of underground cables were used for making the connections between the Board's sub-stations and the busbars of authorised undertakings at 33, 11 and 6.6 kV. During the whole period since supply was commenced only one unexplained fault had occurred, that being on a 0.75 sq. in. single-core 11-kV cable. Only two other cable faults had occurred, one due to mechanical damage and one due to the oil used in oil-filled switchgear finding its way into a cable-end box where a different compound was used and causing breakdown. The largest power cables in use were 1.25 sq. in. and the smallest 0.2 sq. in.

The paper concluded with a brief account of the system of record keeping for maintenance organisation, the cards, in addition, providing a means of showing what work was due to be done during any period.

A large number of questions were put to the author in the discussion, and the following is a summary of his replies.

The painting of transformer radiator tubes was difficult, he said. The best thing at the moment was to space the tubes sufficiently far apart, and the existing method was to scratch and paint the surfaces with brushes of special shape. Spraying had been tried without complete satisfaction. The grade of oil used for the transformers was B2 and no trouble had been caused by acid content. When washing insulators the water was not at very high pressure by the time it reached the top of a 70-ft. tower; the pressure of the pump was 96 lb. per sq. in. and there had been no trouble through water entering bushings, &c. The whole secret of that washing process was that it should be done at quite frequent intervals in order to prevent the accumulation of thick layers of dirt. There had been no flash-overs in the Central England area. Considerable use had been made of graphite paints on towers and steel structures. About four years ago in the Stoke district during a heavy blizzard 5 in. of ice formed on the conductors, which sagged heavily, but no damage was done to the line conductors.

Heat-resisting Steels

WHEREAS the yield with time of mild steel falls to 400 lb. per sq. in. at 700 deg. C., alloy steels are now available with a time yield of not less than 3,360 lb. at that temperature. This means that substantial stresses may be borne, even at red heat, with reasonable permanence of dimensions. At the same time, these special steels are capable of resisting to an astonishing degree the oxidation that accompanies scaling due to elevated temperatures.

The addition of chromium alone increases the resistance to oxidation, but does not improve the strength of the steel. The dual result is attained by the inclusion, in addition, of substantial quantities of nickel, and tungsten is valuable in assisting to impart greater strength. Which and how much of each element should be added for particular service conditions is of considerable moment, economically.

To illustrate how the selection of appropriate compositions will ensure required properties, Mr. M. H. Hatfield (Firth-Vickers Stainless Steels, Ltd.) has attempted a quantitative evaluation of fourteen different alloys in a paper read before the INSTITUTE OF FUEL in London on March 24th. A long appendix contains data in detail on the composition and properties of each material, and an unusually full bibliography is included.

These alloys have symbol designations, and typical uses include the "H.R.C." and "I.4.W." grades for superheater supports. These steels have the greatest mechanical strength and can be welded and obtained as castings, forgings, sheet, wire and bars, but are not produced in the form of solid drawn tubes.

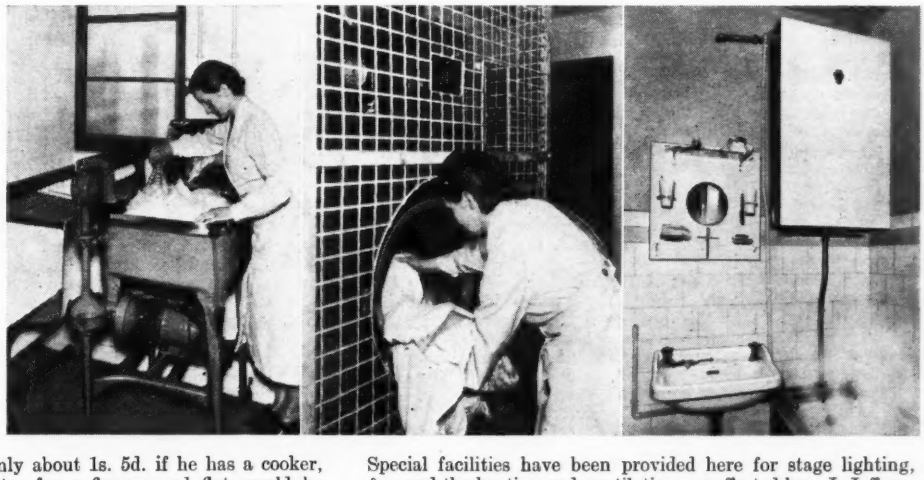
The "5.F.D.P." grade is used for super-heater tubes, parts of mechanical stokers and as sheaths for domestic electric cooker elements. It withstands serious oxidation up to 800 deg. C., can be welded, obtained in practically any form and manipulated or fabricated by any of the methods employed for ordinary steel, hot or cold. Grade "I.5" steel is used for making electric tubular heaters for heat treating wire at 1,050 deg. C.

The author expresses confidence that substantial advances will continue to be made.

Rehousing at Hackney

NISBET HOUSE, Homerton, one of three similar enterprises recently undertaken by the Hackney Borough Council in connection with slum clearance and the relief of overcrowding, is of exceptional interest electrically on account of the unusually extensive installation.

Covering a 5-acre site the estate comprises 311 flats, each of which has been equipped with points for lighting, heating, water heating, cooking and ironing, and, although gas is also available, the favourable electricity tariff has resulted in most of the tenants electing to "go all-electric." Typical examples of the charges given to us by Mr. E. A. Mills, the borough electrical engineer, who has been responsible for the electrical side of the scheme, show that the weekly bill of a tenant of a one-roomed flat is only about 1s. 5d. if he has a cooker, and 1s. without. The rates for a five-roomed flat would be about 4s. 1d. and 2s. 11d.



Some of the electrical features of Nisbet House, Hackney: One of the washhouse cubicles, a rotary dryer and a 12-gal. water heater supplying bathroom and kitchen

The size of the cooker supplied is suited to the size of the flat, Revo apparatus being standardised. The electric fires are also of Revo manufacture, and for the small appliances such as kettles and irons Hotpoint equipment is used. Hot water for the bathroom and kitchen comes from a thermostatically controlled 12-gal. Heatrae water heater (4 kW).

Probably the outstanding feature of the scheme is an all-electric laundry for communal use. Each of the sixteen cubicles of the washhouse is provided with a standard Hotpoint electric washing machine, together with sink, draining board, running hot and cold water and an outlet gulley. The hot water for the sink as well as for a communal tap outside the washhouse for staircase cleaning, &c., comes from two 200-gal. tanks arranged in parallel in a special tank room. These are each heated by Heatrae immersion elements loaded at 48 kW and controlled by thermostats.

By means of a rota the tenants are able to reserve for their own individual use one of four Braithwaite electric drying machines of the rotary tumbler type. The "wash" is placed in the perforated drum which is rotated slowly inside the drying chamber of the machine by a ½-h.p. motor. Air drawn in by a 1.1-h.p. electric motor is warmed by a 30-kW heating unit and passed through the drying chamber at about 200 deg. F. and exhausted through trunking to atmosphere. Control is by a single push-button switch, which is interlocked with the door of the drying chamber. The drying time for a typical family wash is about twenty-five minutes. Exhaust fans (Keith Blackman) are fitted in the washhouse and electric clocks (Smith's) are located at various places.

Immediately over the laundry is a communal concert hall. Special facilities have been provided here for stage lighting, &c., and the heating and ventilation are effected by a J. Jeffreys & Co.'s plenum system incorporating a 30-kW Bray heater fitted with "Sathwell" thermostats." The internal lighting of the staircases, entrance number boxes and external lighting is controlled by time switches. Electric goods lifts (Hammond & Champness) are installed at each of the fifteen staircases.

To cater for these various services a 4-wire, 400/300-V, 50-cycle a.c. supply is afforded by a sub-station on site containing two 500-kVA Johnson & Phillips transformers with Ferranti automatic on-load tap-changing equipment. Fire protection is provided by "Lux" CO_2 equipment (Walter Kidde). B.T.H. high-voltage switchgear is used, the l.v. switchboard having been supplied by Ferguson Pailin, Ltd. The distributor cable encircles the estate in two sections, rising mains running to distribution boards (Foster) feeding lateral service lines. With the exception of the latter, for which v.i.r. cables in enamelled screwed conduits (Seal Conduits, Ltd.), are used, all the distribution cables (Johnson & Phillips) are of the paper-insulated lead-covered type, steel tape armoured where laid underground. G.E.C. tumbler switches and Wandsworth socket outlets have been employed. The electrical installation was carried out by F. H. Wheeler & Co., Ltd., and the laundry installation by the Cherry Tree Machine Co., to Mr. Mills's specifications.

Parliamentary News (BY OUR SPECIAL REPORTER)

Oxford Electricity Bill

The Standing Orders Committee of the House of Lords, presided over by Lord Onslow, heard on March 23rd an application for leave to promote the Oxford Electricity Bill authorising the Oxford Corporation to purchase the Oxford Electric Company's undertaking. Mr. Parker, Parliamentary agent, said that owing to the late preparation of the Bill certain notices were given later than the prescribed dates and therefore the standing orders had not been complied with.

The Committee decided to allow the standing orders to be dispensed with and later the Bill was presented to the House and read a first time.

Trolley Vehicles for Gateshead

Rival claimants for the right to run trolley vehicles in Gateshead appeared before a Select Committee of the House of Lords presided over by Viscount Mersey last week. The Gateshead and District Tramways Co. promoted a Bill to enable it to abandon tramways and run other vehicles, and Gateshead Corporation promoted a Bill to give it powers to purchase the company's tramway undertaking and substitute trolley vehicles with extended routes.

Sir Walter Monckton, K.C., appearing for the Tramways Co., said the object of its Bill was to enable the company, as and when circumstances required, to abandon tramways and substitute either omnibuses by a working agreement with an associated company, the Northern General Transport Co., or trolley vehicles under its own operation. It was not possible yet to lay down a definite programme for they had an arrangement for joint working with Newcastle and the provision of trolley vehicles must depend to some extent on the policy of Newcastle. He submitted that the purchasing powers of Gateshead Co. over the company's tramways had lapsed, but there was in this Bill an option to the Company to purchase the Company's trams or trolley vehicles in 1968.

Mr. H. A. Stagg, resident director of the Northern General Transport Co. and associated companies, giving evidence in support of the Tramway Co.'s Bill, said that the tramways system had been maintained and the system had received a good deal of praise. If he had a free hand he would replace the trams by omnibuses which would work in with the Northern General services, but they had to bear in mind the necessity of maintaining communication with Newcastle. There were a good many questions to consider in connection with trolley vehicles. One was the cost of fuel. They were paying 0.85d. per kWh for electricity for the tramways and it was doubtful if trolley vehicles would be justified at such a price. There was also the question whether trolley vehicles would be allowed to cross the Tyne without the bridge flooring being reconstructed.

Mr. J. Abady, K.C. (for Newcastle Corporation) asked if the design of trolley vehicles had not been improved and the capacity increased. Mr. Stagg said that that was so to a point which was the limit. More than 70 people could not be carried in a six-wheeled vehicle no matter how much it was improved.

When the Committee met on March 24th Mr. Craig Henderson, K.C., for the Gateshead Corporation, in reply to questions by the Chairman, said that if the Corporation got its Bill for the acquisition of the tramway company's undertaking it was the intention to make an agreement with the Newcastle Corporation to manage it.

Mr. Arthur R. Hoare, consulting engineer, giving evidence in support of the Tramway Company's Bill, said he thought it was not possible in this area to say in advance whether trolley vehicles or buses should be used to replace the trams. The question should be considered route by route. He agreed that trolley vehicles had a number of advantages. The motor bus had the advantage of being able to overtake another.

In reply to the Chairman, Mr. Hoare said that twenty-six municipalities which formerly operated trams had changed to trolley vehicles.

On March 25th a suggested compromise was put forward by Sir Walter Monckton, K.C., on behalf of the tramways company. He said that if the Newcastle Corporation applied for and obtained within three years a Provisional Order enabling it to run trolley vehicles on the through routes between Newcastle and Gateshead, the tramways company would follow suit. It would run trolley vehicles also and would not seek to put in force the bus powers in this Bill and would not run buses which competed with the trolley vehicles.

Mr. Craig Henderson said the offer was not acceptable to his clients. Opening the case for the Corporation Bill Mr. Craig Henderson said he could not understand the argument that the Corporation had lost its right of purchasing the tramway company's undertaking.

Evidence in support of the Corporation Bill was given on March 28th by Ald. Thos. Peacock, who said he felt that the tramways company did not want to introduce trolley vehicles. The people who controlled the tramways company were bus people whose ultimate object was to run buses and take trams off the streets altogether. Conversion to trolley vehicles would cost round about £250,000.

Answering Lord Gifford, Ald. Peacock said that they were assured that trolley vehicles had been so successful in Newcastle that it was the intention of the Corporation to make the interconnection with Gateshead a trolley vehicle service.

Mr. A. C. Baker, general manager of the Birmingham Transport Department, said his experience was that receipts increased enormously when trams were converted to trolley vehicles. Trolley vehicles not only had the advantage of comfortable riding and kerbside loading but tramcar drivers could easily be taught to drive them. Excluding London there were 27 local authorities and five companies which had changed over to trolley vehicles. Where such vehicles had been abandoned it was before the trolley vehicle had become the effective vehicle it was to-day. In 1933 local authorities ran 162 trolley vehicles and now the number had increased to 1,320.

Sir Walter Monckton said that Keighley abandoned altogether 20 vehicles. It was done in two stages. Mr. Baker accepted that and said he agreed that in considering conversion schemes the circumstances of each particular case must be taken into account.

The Committee adjourned until March 31st.

Electrical and Telephone Developments

On March 25th, during a debate on economic conditions and unemployment, the Minister of Labour said that loans sanctioned by the Electricity Commissioners, excluding borrowing by the Central Electricity Board, amounted to £24,000,000 during 1936-37 as compared with £17,000,000 in the previous year. The Central Board was empowered to borrow up to £60,000,000 for the construction and acquisition of main transmission lines and purposes connected therewith, and the standardisation of frequency. At present, he understood, borrowing had been sanctioned up to £52,500,000. Apart from that, the Board could, with the approval of the Electricity Commissioners, direct authorised undertakers to carry out extensions and alterations, and during 1936 the estimated amount of expenditure involved in such directions was £12,500,000 spread over the next two or three years. Loans sanctioned in 1936-37 in connection with the conversion of tramway services to trolley vehicles or omnibus services amounted to £1,750,000.

In the case of the Post Office the total expenditure on the engineering programme was £21,500,000 in 1936-37, of which nearly £14,000,000 was in respect of new works of construction in connection with the telephone and telegraph services. It was anticipated that there would be a considerable increase in the capital expenditure on telephone equipment in the current year. The actual expenditure on the engineering programme was estimated at about £27,000,000.

In the Courts

An Insecurely Fenced Hoist

In Arbroath Sheriff Court last week Francis Webster & Sons, Ltd., spinners and manufacturers, Arbroath, were convicted on a charge of neglect to observe a section of the Factory and Workshop Act, 1901. A hoist was not securely fenced, and, in consequence, an apprentice electrician died through falling down the well of the hoist. The company pleaded not guilty.

Mr. L. N. Duguid, engineering inspector of the Factory Department of the Home Office, and chairman of the British Standards Committee on Hoists, who gave evidence for the prosecution, said the hoist in question could be considered securely fenced in terms of the Act only if it had a permanent attendant, or, alternatively, if any person desiring to use it went up and down the different flats to find the position of the cage and entered it before attempting to operate it by means of the rods. Even although the door of any flat at which the cage was not resting was shut, the fact of opening the door in order to lean into the well and manipulate the rods to operate the hoist was an extremely dangerous procedure.

For the defence it was stated deceased had been frequently warned not to make use of the hoist or to try to operate it. Imposing a fine of £5 the Sheriff said the Act was designed expressly to protect even wilful and wayward workmen against their own foolishness and recklessness.

British Electric Domestic Appliances, Ltd.

In the Companies' Court on March 28th Mr. Justice Bennett had before him a petition for the compulsory winding up of British Electric Domestic Appliances, Ltd., the petitioners being Messrs. A. Preen and G. Preen.

Mr. Cecil Turner said it was a creditors' petition, and after the presentation of the petition a meeting of the company was held, and the result was that a resolution for the voluntary winding up of the company was passed, and this had been approved by the creditors. He (counsel) therefore asked that the petition should be dismissed.

His Lordship assented, and dismissed the petition accordingly.

Telsen Electric v. Eastick

The case of the Telsen Electric Co., Ltd., *v.* J. J. Eastick & Sons again came before the Court of Appeal, consisting of Lords Justice Greer, Slesser and Clauson, on March 28th on the

(*Continued on page* 471.)

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Engineering Films

I am compiling a list of 16-mm. films available for showing to engineering societies and similar bodies and I should be very glad to hear from companies who have such films dealing with any technical aspect of their business in order that I can add their names to my list and at a later date make arrangements to include these films in the programmes which form part of our winter lecture sessions.

The Society's membership is drawn from most branches of the profession, from well boring to aeronautics, and there are few technical subjects which would not be of interest. We have an up-to-date projector and normally arrange our own showing unless the company concerned wished to send its own representative.

J. B. Hewitson,
5, Chalgrove Way, *Hon. Secretary*,
Emmer Green, Reading Engineering Society.
Reading, *March 25th.*

Air Purifiers for Anti-gas Shelters

In your last issue a description was published of a German design of ventilation unit for air-raid shelters.

Evidently there is some mistake in the information given to you, as, according to the standard laid down by our A.R.P. Department, these units would be suitable for 4 to 5, 8 to 9, and 17 persons, respectively, instead of up to 50, 100, or 200 persons, as stated. The standard in this country is 2½ cu. ft. of air per minute per person, and even at this the volume supplied is only from one-fifth to one-tenth of that in normal ventilation of buildings.

Bombee.
March 25th.

I.E.E. Membership Regulations

I am glad to see that graduates are criticising the regulations for transfer, for I think they have a sound case, which holds good also for transfer from associate member to member.

Men whose work brings them continually into contact with corporate members will find it difficult to appreciate the position of those who work alone and whose work is known only to their non-technical employers. These men cannot find five corporate members having sufficient personal knowledge of the applicant to give convincing answers to the unnecessarily inquisitorial questionnaire which the Institution sends to sponsors, and it is altogether unreasonable to disqualify a man on this point. It should be quite sufficient if one corporate member is prepared to vouch for an applicant without reservations, and even this should not be an essential condition.

Then there is the question of responsibility, which is difficult to assess, but it may be worth pointing out that a man who is working alone must rely on his own judgment and technical knowledge for the solution of his problems, and he cannot avoid taking responsibility for his mistakes. In this respect his responsibility may be more real than that of a man who directs a large technical staff, although his importance and social position may be inferior. I wonder if the Council has ever confused responsibility with importance and social position?

A further ground for criticism is the rejection without explanation of applications for transfer. An applicant is entitled to know in what respects he is held to be deficient; moreover, where rejection is contemplated, an applicant should have the opportunity of amplifying the particulars he has given, or of presenting his case in person to a membership committee of the Council.

One of your correspondents thinks that employers should understand the technical qualifications implied by the various classes of membership, and I imagine there will be general agreement with this view. The non-technical employer, however, can hardly be blamed for ignorance in this matter. The fault, surely, is with the Institution, which establishes these standards, but fails entirely to acquaint the world with them. Even a technically minded employer might be pardoned if he is confused by the several classes of membership and what they stand for.

A.M.I.E.E.
March 26th.

I feel sure that it is time that something was done to alter the very unfortunate state of affairs in regard to I.E.E. membership. This must have a deterrent effect on the progress of the electrical engineering industry as a whole, as it tends to keep out large numbers of those who have a great knowledge of practical work in addition to theory but who cannot afford for various reasons to comply with the unfair regulations of the I.E.E.

Unless the large electrical concerns do something, the industry will not have enough representatives to help it forward, as these latter are held back by "red tape."

Bristol, *March 26th.* R. W. Rapson,
Chief Service Engineer,
Workman, Reed & Co., Ltd.

Change-over Questions

In reply to "Fairplay" I have had some experience of d.c. to a.c. change-over work and of the difficulties which arise in connection with it.

My opinion has always been that when changing-over the consumer must not be made better off, nor, on the other hand, worse off. I have on several occasions had to provide stand-by plant, but not of the magnitude mentioned by "Fairplay," and would suggest that consideration could be given to the supply of rectifiers, which would certainly cost less than new stand-by plant.

F. F. P.
March 25th.

I consider "Fairplay's" client is receiving perfectly fair treatment from the undertaking concerned. The facts are, apparently, that the client decided to take supply on the off-peak system at a reduced tariff and in order to keep his plant running he chose to install a stand-by plant rather than take the full-time supply offered by the undertaking. The latter is now changing over to a.c. and has offered to make the existing plant suitable for this supply, with the exception of the stand-by plant for which, quite reasonably, I think, it refuses to be responsible.

If a consumer avails himself of the advantages of a cheap tariff and then finds that he must install additional plant to deal with the difficulties of a curtailed supply, although full-time supply is available, then the consumer is responsible for the additional plant in the event of a change-over. He cannot expect to gain both ways.

The consumer should probably feel satisfied that the undertaking has agreed to be responsible for the remainder of his plant, since there are some who, I believe, will not even go that far.

R. F. Burston.
Pwllheli, *March 28th.*

In the Courts. (Concluded from page 470)

appeal of the defendants from an interlocutory order made by Mr. Justice Lawrence in Chambers.

Mr. Croom-Johnson, K.C., who appeared for the defendants, said that the parties had now arrived at a settlement of the dispute and Mr. Justice Lawrence had made an order staying all further proceedings in the action, and in these circumstances he (Mr. Croom-Johnson) asked the Lords Justice to dismiss the appeal without costs. The Court concurred.

A Railway Signalling Patent

A pending patent action which involved many thousands of pounds already spent came before Mr. Justice Simonds in the Chancery Division on March 25th, the plaintiffs being General Railway Signals, Ltd., who are claiming against the defendants the Westinghouse Brake & Signal Co., Ltd., an injunction to restrain the alleged infringement of plaintiffs' letters patent.

Mr. Trevor Watson, K.C., for the plaintiff company, now applied for leave to amend the specification of their patent. He said that the action related to a very complicated system of railway signalling.

Mr. R. Kenneth Swan, K.C., for the defendants, opposed the application for leave to amend. He said that this extremely prolonged and complex litigation was commenced in September, 1935, and but for the present application the case would be ripe for trial at the commencement of the next sittings (April 26th). His clients were extremely anxious that the action should be determined at the earliest possible date. The matter concerned the automatic control of railway signals and points. The installation was of a gigantic character and involved many thousands of pounds. The complaint in the case was directed to the installation of such a system between Wembley and Stanmore. Every week the litigation continued the damages, if it were found that there had been infringement, were piling up and defendants' business was paralysed. Not only that, but the plaintiffs were seeking to get the railway companies to adopt a competitive system. The prolongation of the action inflicted great damage on the defendants.

His Lordship said he would give the plaintiffs leave to proceed with the application to amend which would come on at the trial of the action on condition that they supplied the defendants within 14 days with a supplemental statement showing the different construction of the specification involved in the amendment. An order was made accordingly.

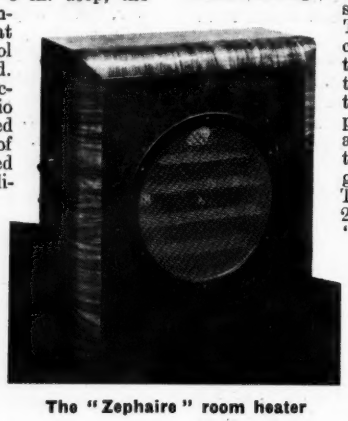
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Room Fan-heater

The latest addition to the fan-heater type of space-heating equipment is provided by PRIOR BURNERS, LTD., 1 and 2, Brandon Road, York Road, London, N.7. Housed in an attractive wooden cabinet 18 in. square by 8 in. deep, the "Zephaire" room heater, as it is called, incorporates nichrome wire elements rated at 2 kW and operating at black heat, a control switch cutting off half or all the heat if desired.

The motor driving the fan is of the induction type and does not interfere with radio reception. Air circulation can be regulated and its direction altered by the adjustment of movable louvres. The fan cannot be switched off except at the source of supply. A humidifier automatically introduces the necessary amount of moisture into the atmosphere, preventing stuffiness, and safeguarding furniture and paintwork. A deodorant can be mixed with the water in the humidifier if desired.



The "Zephaire" room heater

A Vactric Vacuum Cleaner

VACTRIC, LTD., Honeypot Lane, Stanmore, Middlesex, have introduced a new model known as the "Senior." It is an outside bag model with a belt-driven revolving brush, the motor being mounted vertically. A special external feature is the complete absence of any screws, giving a clean outline. The finish is aluminium lacquer and clear lacquer on the main casting, black enamel on the motor body with a black enamelled handle and black bag stencilled white. The switch of the toggle type is mounted on the top of the rubber handle grip.

The Vactric "Senior," which incorporates a rotary motor-driven brush and a 25-W headlight

The adjustment of the nozzle height is by foot action on a pedal, a clear indication of the height employed being given by a numeral appearing in an aperture on top of the main casting. A single speed universal motor, having mounted in front of it a 25-W electric lamp covered by a protective grille, is fitted, its speed being in the region of 7,800 r.p.m., producing a speed of about 3,000 r.p.m. on the revolving brush. Ball bearings are employed throughout in the motor and revolving brush and roller bearings are used in the four wheels. The loading is 280 W.

The following are the dimensions: height in storage position, 3 ft. 8½ in.; height to top of motor, 7¾ in.; width overall, 13½ in.; length of extension cord, 25 ft. The air displacement is from 60 to 65 cu. ft. per minute.

An Electric Lock

A characteristic of the "Zettler" lock, which is being sold in this country by E. R. MORTON, LTD., 11, Newman Street, London, W.1, is that the locking and unlocking action is actuated by the same magnetic system. The operation is such that the rating is only 30 W at 24 V for approximately 1/25 sec.

The magnetic system, collector and brushes, together with the connecting terminals, is contained in a metal housing with an all-insulated cover available in various colours. On rotation the bolt travels through an angle of 90 deg. and the two push-buttons which operate the lock are contained in a polished white or brown-black cover.

Arrangements can easily be made for right- or left-hand opening doors, and the locking of the door can be carried out, if required, from several points.

Sound Amplifiers

Additions have been made recently by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, to its range of sound amplifying equipment for a.c. mains by chassis of 30 W and 60 W respectively. Both assemblies are available in five different forms: as chassis units, chassis units with protective covers, in cabinet form, as a panel for rack mounting, and as a twin turntable assembly.

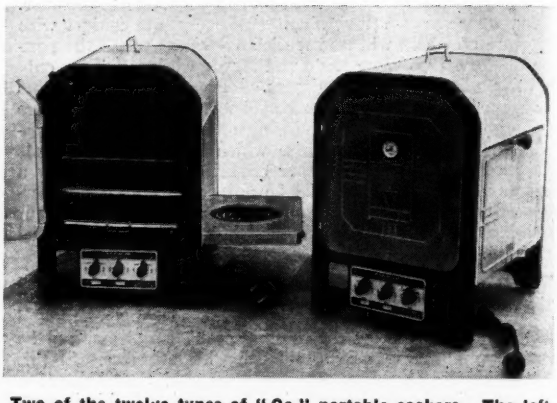
The chassis for all the series makes use of interchangeable units, so that the same unit employed for the 30-W assembly can be converted into a 60-W assembly by adding two additional valves and by replacing the power pack. Thus the same housing covers, cabinet, panel or gramophone assembly serve the amplifiers of both power ratings. The amplifier chassis, metal clad, with black crystalline finish, encloses all live connections. It embraces a four-stage circuit, with two power valves in push-pull in the case of the 30-W equipment and four in parallel push-pull for the 60-W. Only two controls are provided: one serves as the input selector switch (covering microphone, radio and gramophone), and the other governs volume. The power pack is designed for use on 200/250-V a.c. mains and is equipped with an "Osram U18" rectifier in the case of the 30-W and two similar valves in the 60-W amplifier.

Portable Cookers

Something quite new in the way of portable electric cookers has been brought to the British market from the United States by the METALCRAFT MANUFACTURING CO. (CANADA), LTD., 72, Newman Street, London, W.1.

Though comprising a full-sized oven (interior measurements: 11½ in. by 14 in. by 10 in.) and two hotplates, this "Go" apparatus weighs little more than 30 lb. and is only 18½ in. high, 15 in. deep and 28 in. wide when in use. With the hotplates folded up one at each side of the oven the width is reduced to 13 in.

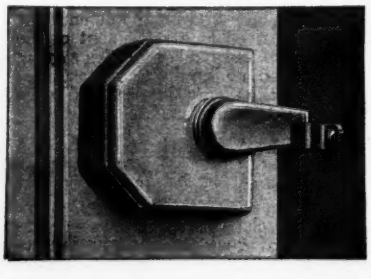
Twelve models are available, all of similar general design but differing in detail. The oven elements, which are tray-like



Two of the twelve types of "Go" portable cookers. The left-hand model has thermostatic oven control

in appearance, are situated a few inches from the base, so permitting grilling beneath. Alternative loadings of 660, 1,100 and 1,600 W raise the oven temperature to 400 deg. F. in approximately 5¾, 6½ and 9 minutes respectively. Double-steel construction with an efficient lagging system gives the oven remarkable good heat-retaining qualities. Several of the models are provided with thermostatic control.

The right-hand hotplate has the same loading as the oven elements, and an interlocked switch prevents its being placed in circuit when the oven is "on" and *vice versa*. This arrangement avoids any risk of overloading. The left-hand hotplate is quite separate and can be supplied loaded at 520, 550, 650 or 1,100 W, the last-mentioned rating



The "Zettler" lock

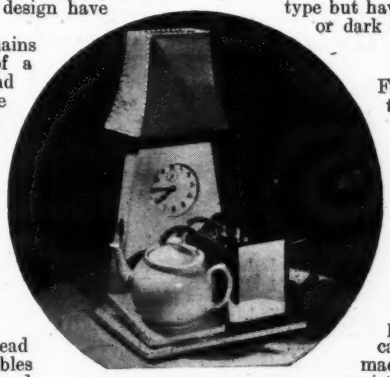
boiling 3 pints of water in about 9 minutes. Replacement of the hotplate elements, which are of the bare-wire radiant type, is extremely simple and necessitates only the removal of a guard and two screws. The cream vitreous enamel finish of the apparatus harmonises with almost any colour scheme.

An Improved "Teesmade" Outfit

The manufacture of the "Teesmade" automatic tea-making outfit has been commenced by the BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Fulham, London, S.W.6. and several improvements on the origin design have been made.

The automatic siphoning action still remains basically the same, but the kettle is of a more pleasing design in chromium plate and a coloured pottery teapot is standard. The lamp and clock are in one piece, the latter being either synchronous or spring driven. The standard model comprises lamp, clock, kettle and teapot. Another model has, in addition, a tray, two cups and saucers, cream jug and sugar basin to form a complete tea outfit.

A strong wooden cabinet can be supplied to accommodate the complete tea set and tray.



"Goblin-Teesmade"

Electric Fires

The opening of a new showroom at its head office at 153, Mason's Hill, Bromley, enables GRAHAM FARISH, LTD., to display to good advantage a number of new electric fires, as well as many already popular models. On a visit a few days ago we had an opportunity of seeing the new 750-W "Sunny Heat" reflector fire which, on account of its low price, is expected to secure a share of the market hitherto held by the bowl fire. A similar 500-W model, which has been on the market for some months, has been reduced in price. The finishes available include oxidised silver, oxidised copper, green, ivory, pink and blue. The popular "Minnie" model can also be obtained in various colour finishes. The growing popularity of the convectors has resulted in the company's producing a *de-luxe* model essentially the same as the standard type but having an improved case in walnut and light or dark oak.

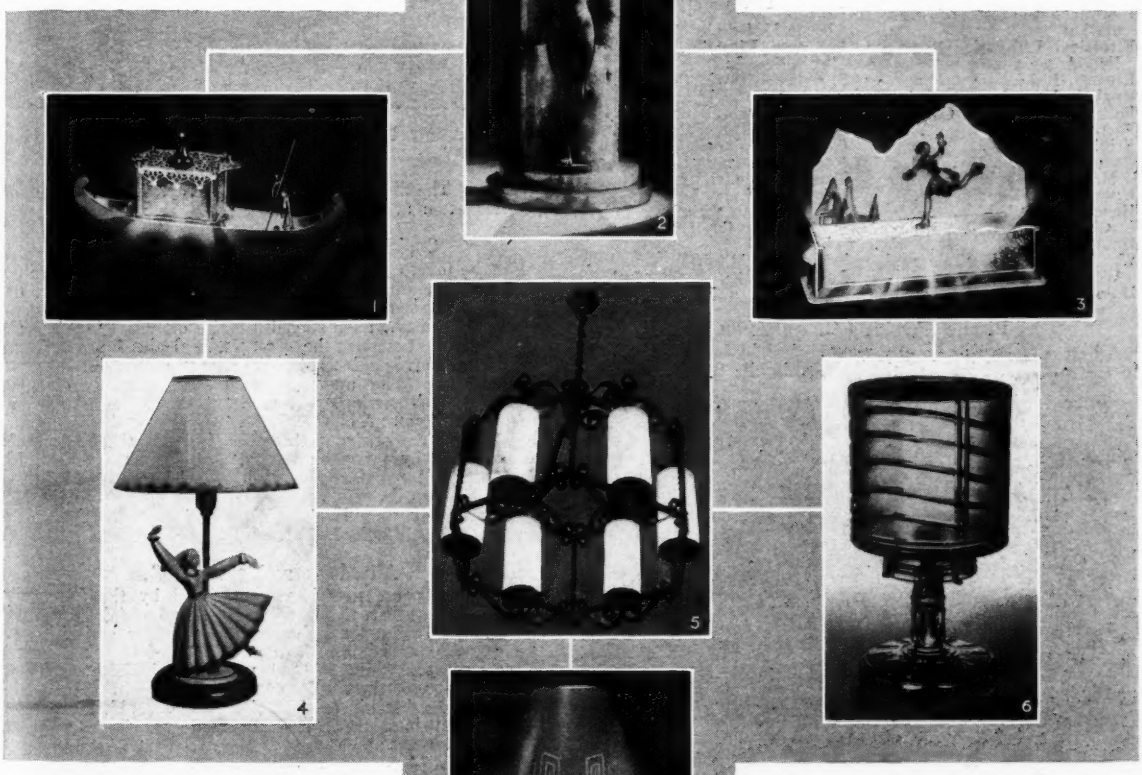
Under-road Cable Laying

For situations where cables or conduits have to be laid without breaking up the surface of the ground, a new Duff-Norton pulling and pushing jack is being marketed in this country by the CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, London, W.1.

The weight of this jack, which measures 6 ft. long and has a travel of 36 in., is 395 lb. It has been designed to provide the advantages of hydraulic apparatus but with the employment of only one man. By manual operation a pipe can be pushed forward and a pipe or cable can be pulled through a previously made hole. The operator is able to tell by the resistance on the operating handle whether an obstruction in the subsoil has been encountered and can then withdraw the pipe by using a reversing lever and ratcheting with the operating lever as with an ordinary lifting jack, thus avoiding the necessity of adjusting the position of the jack itself. For pipes exceeding 6 in. in diameter or for pulling through cable the standard pipe is pushed forward and an enlarging nipple is fitted with a special grip; the jack is reversed and operated as for pushing.

Modern Lighting Fittings

IN looking round the recent British Industries Fair we found a number of attractive displays of electric lighting fittings, many of them novel in design. Illustrated below are a few of these. Among the novelties is an interesting range by A. J. PEPPER & CO., LTD., Pimpernel Works, Great Hampton Street, Birmingham, whose illuminated gondola (1) and skating girl (3) aroused considerable interest. The company also produces a model aeroplane lighting fitting, a tennis racquet and a ship embodying a tubular lamp. The tennis racquet should be useful as a prize for tennis clubs, combining as it does utility and decoration. Vase and statuette lamps are a speciality of the BRITISH ALABASTER & ARTS CO., LTD., Weston, Stafford, of which the silhouetted figure of a girl (2) is one example. The EDGWARE SHADE CO., 23/25, Parkway, Stag Lane, Edgware, has a number of table standards with figures, the dancing girl (4) being typical of many. A hexagonal pendant fitting (5) is an attractive new addition to the range of wrought-iron lighting units produced by KNIGHTSHADES, LTD., Derby Road Works, Montague Road, Edmonton, London, N.18. It is supplied in three finishes, black, ivory and green, and ivory and brown, the six cylindrical shades being available in practically any colour, and all lanterns and wall brackets are made to match, the latter being suitable for mounting either against a wall or in a corner. Glass is employed, both for the shade and stand, by THOS. WEBB & SONS, Dennis Glassworks, Amblecote, Stourbridge, Worcs, in a striking cylindrical fitting. (6). DERNIER & HAMLYN, LTD., have a large range of decorative table standards with pottery bases (7) in various colours and fitted with a variety of shades. These are only examples from wide ranges.



Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The I.M.E.A. Exhibition

As is customary, an electrical exhibition is to be arranged in conjunction with the Incorporated Municipal Electrical Association's Convention, which is to take place this year at Torquay from May 23rd to 27th. It will be held at the Devon General Omnibus and Touring Co.'s premises in Torwood Road and the eighty or so names of the exhibitors given below indicate that the display is likely to be a very representative one.

Aidas Electric, Ltd.
Arrow Electric Switches, Ltd.
Automatic Telephone & Electric Co., Ltd.
Bastian & Allen, Ltd.
Belling & Co., Ltd.
Berry's Electric, Ltd.
Bratt Colbran, Ltd.
George Bray & Co., Ltd.
British Electrical Development Association.
British National Electrics, Ltd.
British Sangamo Co., Ltd.
British Thomson-Houston Co., Ltd.
Bulpitt & Sons, Ltd.
Burco, Ltd.
Carrier Weathermakers, Ltd.
Carron Company.
E. K. Cole, Ltd.
Corfield-Sigg, Ltd.
Diamond H. Switches, Ltd.
Drake & Gorham Wholesale, Ltd.
Edison Swan Electric Co., Ltd.
Electric Lamp Manufacturers' Association
Electric Vehicle Association
Electrical Apparatus Co., Ltd.
Electrical Association for Women
Electrical Contractors' Association
Electrical Industries Benevolent Association
Elexcel, Ltd.
English Electric Co., Ltd.
Falk Stadelmann & Co., Ltd.
Ferranti, Ltd.
Frigidaire, Ltd.
General Electric Co., Ltd.
H.M.V. Household Appliances
Hague & McKenzie, Ltd.
Harcourts, Ltd.
L. G. Hawkins & Co., Ltd.
Heatrae, Ltd.
W. T. Henley's Telegraph Works Co., Ltd.
Holophane, Ltd.
Hoover, Ltd.
Horstmann Gear Co., Ltd.
Hotpoint Electric Appliance Co., Ltd.
Hurley Machine Co., Ltd.
International Refrigerator Co., Ltd.
Ismay Distributors, Ltd.
J.P. Tubular Heater Co., Ltd.
Jackson Electric Stove Co., Ltd.
Johnson & Phillips, Ltd.
Lightfoot Refrigeration Co., Ltd.
Archibald Low Electrics, Ltd.
Donald Macpherson & Co., Ltd.
McGregor & McCallum, Ltd.
Measurement, Ltd.
Metropolitan Vickers Electrical Co., Ltd.
Moffats, Ltd.
Premier Electric Heaters, Ltd.
Pressed Steel Co., Ltd.
Pyrotenax, Ltd.
Radio Grant
Radiovisor Parent, Ltd.
Revo Electric Co., Ltd.
Reyrolle & Co., Ltd.
Rheostatic Co., Ltd.
H. W. Rodda & Co.
Rubery Owen & Co., Ltd.
Santon, Ltd.
George H. Scholes & Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Simplex Electric Co., Ltd.
Smith Meters, Ltd.
Standard Telephones & Cables, Ltd.
Stokes Appliances, Ltd.
Bertram Thomas
Torquay Electricity Dept.
Tricity Cookers, Ltd.
Venner Time Switches, Ltd.
H. Webb & Co. (Engineers), Ltd.
Wilkins & Mitchell
J. W. Woolley & Co., Ltd.
Zeros (Sales), Ltd.

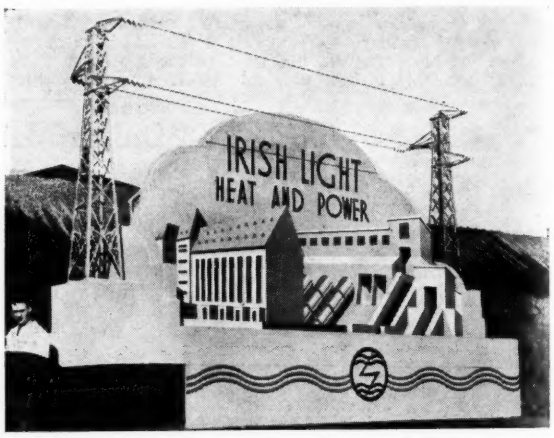
Public Speaking Competition

A high standard of oratory was reached by the competitors in the National Finals of the E.D.A. Public Speaking Competition held at Savoy Hill on March 24th. There were twelve competitors from all parts of the country and the subjects were "Electricity and Kitchen Planning," "Electric Light means Brighter Homes and Better Sight," and "Why you should have Electric Refrigerators." The first-named subject proved most popular, half of the entrants making it their choice; five dealt with light and only one with refrigerators. The judges were the Hon. Mrs. Sebastian Earl and Messrs. G. S. Francis, R. W. Hughman and J. R. Johnson. They adjudicated as follows.—Ladies: 1st, Miss P. Hornsby-Smith (Central London Electricity, Ltd.); 2nd, Miss F. M. Griffin (Bristol Electricity Dept.); 3rd, Miss C. Williams (Wrexham Electricity Dept.). Men: 1st, Mr. H. Hewitt (Swinton and Pendlebury Electricity Dept.); 2nd, Mr. W. S. Williscroft (Hull Electricity Dept.); 3rd, Mr. H. W. Rees (Cardiff Electricity Dept.). Mr. J. I. Bernard presided over the proceedings

The prizewinners in the E.D.A. Public Speaking Competion: From left to right: Miss C. Williams, Mr. H. Hewitt, Miss F. M. Griffin, Mr. W. S. Williscroft, Mr. H. W. Rees, and Miss P. Hornsby-Smith; Mr. Alex. C. Cramb, Director of E.D.A., is in the background

An Electrical Tableau

The accompanying illustration shows a display lorry designed by publicity department of the Irish Electricity Supply Board which took part in a parade of Irish industries through Dublin recently. The display was designed to represent the Shannon power station at Ardnacrusha.



The Electricity Supply Board's entry in a recent parade of Irish Industries in Dublin

Cooking Demonstrations at Poplar

For the fourth year in succession the Electricity Committee of the Poplar Borough Council and Mr. R. Illingworth, the borough electrical engineer, in collaboration with the General Electric Co., Ltd., have staged a series of mass electric cooking demonstrations at the East India Hall, Poplar. These took place from March 22nd to 25th, with afternoon and evening sessions. The audience numbered upwards of 1,000 people at each session, and refreshments were provided as well as free gifts. A clever playlet "Happiness is just around the corner" demonstrated how happiness in the home could be promoted by using electricity, and Jack Upson and his band provided popular musical items. The success of these annual cooking demonstrations may be gauged from the fact that since they were instituted nearly 10,000 electric cookers have been installed in Poplar.

Aberdeen and the J.I.C.

Aberdeen Corporation is recommended by the Electricity Committee to rejoin the Scottish Joint Industrial Council for the Electricity Supply Industry, but to defer a decision on the question of joining the Scottish District Joint Board. Wage increases costing £6,359, together with shorter hours, would be among the results of membership of the Industrial Council. Membership of the Joint Board would, it was estimated, result in salary increases, spread over about five years, of £1,067 per annum.

Gainsborough Electrical Exhibition

An electrical exhibition was held in the Town Hall, Gainsborough, from March 9th to 16th. Cookery lectures and washing demonstrations were given daily, there being a film show at the end of each demonstration. The exhibition also consisted of a comprehensive display of all classes of electrical domestic appliances together with completely furnished model rooms, comprising bedroom, bathroom, kitchen and dining-room. Two large rooms were taken for this exhibition, but owing to the very large crowds which attended the opening ceremony it was found necessary to take the main hall of the Town Hall, and part of the exhibition, together with the cookery demonstration section, was transferred to this hall on

Thursday morning (March 10th). The added expenditure and labour was amply justified, well over three hundred people attending each cookery lecture on that day, apart from the very large numbers walking round the remaining two halls. These large attendances were maintained to the end of the exhibition, and Mr. H. Breckell, engineer and manager of the Gainsborough U.D.C. Electricity Department, states that from the interest shown in the exhibition by the general pubilc there is every reason to expect an appreciable increase in the number of domestic electrical appliances in use in the near future. The names and addresses of the people attending the cookery lectures were obtained by asking them to fill in suitable cards from which a draw was carried out at the end of each cookery lecture, and the first three names drawn were awarded a prize consisting of the food cooked at that demonstration. This has made it possible to secure a very comprehensive mailing list from which it is possible to keep in contact with all interested consumers.

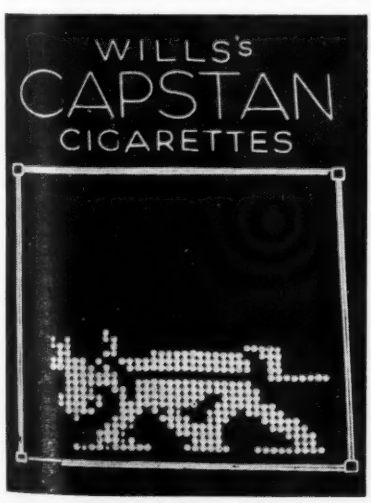
A model electric kitchen at Electricity House, Ltd., Leeds

Rectifier Efficiencies

An important feature of the 2,000-kW Hewittic glass-bulb rectifiers installed in the sub-stations of the extension of the electrified section of the Bombay, Baroda and Central India Railway is that their high efficiency is maintained at all loads. A printer's error occurred in the article on "Grid-controlled Traction Rectifiers" published on page 432 of the Electrical Review of March 25th in regard to the overload efficiency obtained in tests of the units. The correct figures of percentage efficiencies at various loads (including transformer and auxiliary gear) were: 95 at 1¼ load, 96.5 at full and ¾ loads, 96.4 at ½ load and 95.2 at ¼ load, with no-load losses amounting to 12 kW.

A New Form of Animated Sign

An electric sign which reproduces a film cartoon is being displayed in Trafalgar Square by British Epok Signs, Ltd. A novel scheme is adopted in which light, of an intensity varying with the pattern on the film, is projected through the latter to fall upon a bank of photo-electric cells of the end-sensitive type in regular formation. The photo-cells influence the grids of Thyratrons, each of which is connected to one of the 1,600 15-W gasfilled lamps comprising the sign, thus causing the appropriate lamps to light up and give a replica of the cartoon on the film. Heating current for the Thyratron cathodes is supplies by forty 100-A 2-V transformers. As the lamps are lighted for only half of the a.c. wave, the film projector, which is the standard size, is synchronised with the 50-cycle supply to run at 16⅔ frames per second. The total area of the sign is 25 ft. square with a 10 ft. heading above it for the advertiser's name in neon tubes. These are controlled, through contactors and relays, by four separate photo-cells and illuminated by spaced markings on the side of the film frames. It is claimed that in regard to the number of photo-cells and Thyratrons used, this installation is the largest of the kind in the world.



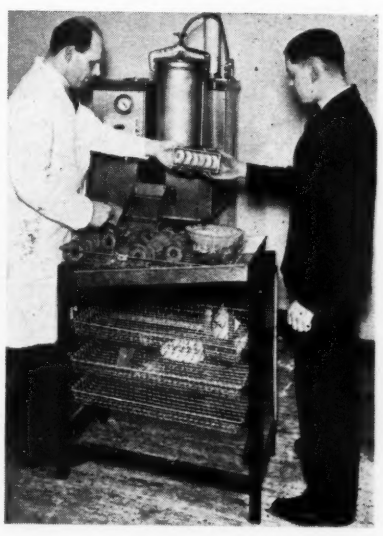
The new Trafalgar Square sign

A Yorkshire Exhibition Kitchen

On March 24th about a hundred representative officers and members of the Electrical Association for Women attended a luncheon as guests of Electricity House, Ltd., and made an inspection of a large model electric kitchen which has been completed, adjoining a conference room at the Thornhill power station of the Yorkshire Electric Power Co. The kitchen has been designed to illustrate the many advantages of electric cooking and kitchen services in cleanliness, efficiency, space economy, easy working and attractiveness of appearance. The visitors were welcomed by Mr. W. B. Woodhouse, managing director of the Yorkshire Electric Power Co. and associated undertakings, who remarked that the primary object of the visit was to show an example of cooking equipment which the company believed was the sort of thing that would be seen more and more in industrial concerns throughout the country. Miss C. Haslett, director of the E.A.W., in addressing the gathering after lunch said the first thing that impressed itself on one's mind was the fact that the people who had prepared the luncheon had themselves been able to join the party and partake of the meal. This was in itself a tribute to the convenience of the electric kitchen. The model kitchen was a very thorough example of what a really modern electric kitchen could be, in which it must be a delight to work. She congratulated the company on its new canteen and conference hall. The kitchen itself illustrated amply the great progress made in kitchen planning. The speaker recalled that fourteen years ago Mr. Woodhouse was the first electrical engineer in the country to address the then new E.A.W. That was at Wembley, when the King and Queen (as Duke and Duchess of York) were present. Mr. Woodhouse on that occasion declared that the time would come when women would know as much about volts as they then knew about velvet. It looked as though that prediction had come true, and Miss Haslett added the observation that it was going to be as easy for women to obtain electrical appliances as it was to buy a hat. Mr. J. E. Rylands, general manager of Electricity House, Ltd., who was responsible for the organisation of the visit, expressed thanks to the visitors for their attendance and their interest.

Swiss Export Directory

The fifth edition of the "Directory of Swiss Manufacturers and Producers," issued with the approval of the Swiss Federal Department of Public Economy by the Swiss Office for the Development of Trade, Zurich and Lausanne, does not differ in essentials from its predecessor. The supplement has been considerably enlarged and the changes of firms have been noted up to January 1st, 1937, and new establishments have been taken into consideration wherever it was found possible. The directory includes an index of products, a classified list of goods, and an alphabetical list of manufacturers. The supplement contains the names of the most important export and transit firms, banks, insurance companies forwarding agents, inquiry offices, consulting engineers, building contractors and patent agents, and includes a special section devoted to the engine-building and electrical trade.



[*Elec. Rev. photo*

A British-American electrically operated doughnut-making machine at Daly's Milk Bar, Leicester Square, London, W.C., which is capable of making thirty-three dozen doughnuts per hour

Birmingham E.D.A. Electrical Circle

The Birmingham Electrical Circle of E.D.A. recently organised a children's painting competition. About 8,000 booklets were distributed in the Birmingham area and approximately 600 entries were received. These entries were judged by Mr. P. Edgar, the Midland Regional director of the B.B.C., Mr. H. Holden, director of the College of Arts and Crafts, Birmingham Education Committee, and Mrs. Frank Forrest, wife of the Birmingham city electrical engineer and vice-chairman of the E.A.W. On March 24th the prizes were presented to the winners at the Birmingham Chamber of Commerce by Ald. Sir Percival Bower. These consisted of three prizes each in Class A (11 to 16 years) and Class B (under 11 years), and in addition there were fifty consolation prizes in each class. At the prizegiving the films "The Science of Seeing," "The Face of Britain," and a "Mickey-Mouse" cartoon were shown. Councillor J. W. Mayall, who presided, proposed a vote of thanks to Ald. Sir Percival Bower, and Mrs. Forrest explained to the children how the entries had been judged.

The Empire Exhibition, Scotland

Models of the Shannon hydro-electric scheme and a train of the future employing a Drumm battery will be features of the electrical section of the Eire Pavilion at the Empire Exhibition to be held at Glasgow this summer. In the Imperial Chemical Industries Pavilion artificial lighting will be employed in a novel way to display various chemicals and dyestuffs will be suggested by an endless variety of colour-patterns shown through fluorescent light. The curious light transmitting powers of the transparent plastic "Perspex" will be demonstrated by passing light through an S-bend tube. Dioramas will indicate some of the more interesting uses of I.C.I. products in industry and agriculture in the Dominions and Crown Colonies.

An Electrical Catering Exhibition

With the hope of encouraging hotel and restaurant proprietors to make greater use of electricity in their establishments the South Metropolitan Electric Light and Power Co., Ltd., is this week and next holding a special exhibition of electrical appliances for catering purposes at its showrooms at 207, High Street, Penge. About seven hundred invitations to attend the exhibition have been sent out to selected consumers all over the company's area and Mr. W. T. Wells, the Penge showroom superintendent, tells us that the response so far has been most encouraging. Apparatus shown includes large cookers, hot cupboards, toasters, fish fryers, plate warmers, urns, girdle cake plates, drink mixers, ice-cream equipment, washing-up machines and exhaust fans. Representatives of the various manufacturers are in attendance and demonstrations are given as required.

Batti-Wallahs' Society

The next luncheon of the Batti-Wallahs' Society will be held on April 13th at the Hotel Victoria, London, W.C., when an address will be given by Ald. J. Chuter Ede.

Calendar

"Hilary," a London-born brunette, is the charming subject of the new calendar of Metropolitan-Vickers Electrical Co., Ltd. Winner of the recent "Miss England" Beauty Competition, the lady forms a worthy addition to the company's series of "girl" calendars.

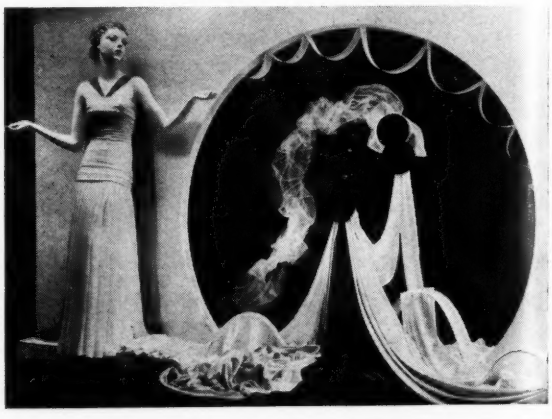
The new Met.-Vick. calendar

German Electrical Exports

Reports of the German Treasury Department on imports and exports of electrical apparatus for 1937 shows that very considerable progress has been made in the development of this branch of business. Almost all classes of electrical exports improved, and the total figures for the year were 23 per cent. higher than those for 1936 and 40 per cent. above those for 1935. The only item in which there was a falling off was bells and signal apparatus, exports of which last year reached only Rm. 3,959,000, as compared with Rm. 5,170,000 in 1936. Among the other items the greatest increase was in exports of apparatus for transmission and distribution lines, which stood at Rm. 70,496,000 for 1937, as against Rm. 59,447,000 in the previous year. Other improvements included wire and cable, Rm. 40,842,000 (Rm. 30,156,000); dynamos and transformers, Rm. 38,050,000 (Rm. 30,559,000); and arc lamps, Rm. 4,409,000 (Rm. 2,192,000). Total exports are given as Rm. 327,982,000 for 1937, as against Rm. 266,240,000 for 1936. On the import side figures are much more modest, although a slight increase is also shown. This was mainly in wire and cable (Rm. 2,908,000 last year against Rm. 1,562,000 in the previous year). Incandescent lamp imports were Rm. 4,365,000 (against Rm. 4,147,000), and imports of radio sets and parts rose to Rm. 7,921,000 (Rm. 5,221,000). Items which showed the most important decreases include transmission line equipment, Rm. 1,134,000 (Rm. 2,111,000); electro-medical equipment, Rm. 81,000 (Rm. 561,000); X-ray tubes, nil (Rm. 327,000); and telegraph and telephone equipment, Rm. 151,000 (Rm. 304,000). The total imports are given at Rm. 19,607,000 (against Rm. 18,157,000 in 1936). The most important customers were the Scandinavian countries, Great Britain coming next. It is interesting to note that for purchases of Rm. 16,363,000 from Germany, Great Britain sells Germany only Rm. 659,000 worth of goods.

A Demonstration Shop Window

The Reimann School recently designed a window display featuring new spring dress goods, which is on view in the showrooms of Holophane, Ltd. The window is equipped with a colour changing lighting scheme in addition to amber and white lighting. A special arrangement has been made with the display class of the Reimann School whereby a display is erected in the demonstration window and the effects from the elaborate colour lighting system are incorporated in the colour scheme. This co-operation between the display artist and the colour lighting expert is training young display experts to make skilful and decorative use of lighting to increase the attractiveness of their displays.



A demonstration shop window in the showrooms of Holophane, Ltd.

Social Events

The annual staff dinner of the North Metropolitan Electric Power Supply Co., Ltd., was held on Tuesday last at Grosvenor House, Park Lane, W.1, Lord Ashfield (chairman of the company) presiding. In proposing the toast of "The Northmet Company," Mr. A. H. Bennett referred to the staff pension funds and thanked the directors for the care and thought put into the schemes. He said the Northmet Co. was a go-ahead company and mentioned two outstanding achievements of the year, the installation of the Lochner boiler at Brimsdown and the meter laboratory at the Outside Department, the successful inauguration of which had been largely due to Mr. G. F. Shotter. Lord Ashfield, in responding, expressed regret that some who had been with them in previous years were absent, due to retirement, and he welcomed those who were there for the first time, mentioning particularly Mr. G. W. Spencer Hawes, of the Harrow Company, who was now a director of the Northmet Co. He mentioned the progress made during the past ten years and stated that during that period the number of consumers had risen from 85,000 to 375,000, the sales from 143,000,000 to 690,000,000 kWh and the gross revenue from £973,000 to £3,000,000. Mr. J. M. Donaldson, in proposing the toast of "The Guests," coupled with it the name of Dr. C. C. Paterson, of the G.E.C. He said that in co-operation with the G.E.C. they inaugurated the first stretch of electric-discharge street lighting at Wembley, which had since been adopted in all parts of the country. Dr. Paterson responded.

About 650 people spent an enjoyable evening at the Leicester Electricity Department's staff dance at the Palais de Danse, on March 25th. The dance is an annual affair, and the proceeds are devoted to charity. Prizes were presented by the Lady Mayoress, who was accompanied by the Lord Mayor. Others who attended included Coun. J. Minto (chairman of the Electricity Committee), Coun. J. Wale (vice-chairman), Mr. J. Mould (general manager), and Mr. D. H. Parry (assistant general manager).

The Pirelli-General Cable Works, Rugby, First XV paid a visit to Callender's at Erith on March 26th. A hard-fought game resulted in a victory for the visitors by 19 points to 6. Following the match the visitors were entertained to dinner at the Rendezvous Restaurant, and subsequently visited the London Palladium.

Prices of Materials

Henry Gardner & Co., Ltd., report, March 30th: Copper bars (best selected), sheet and rod, £73, £2 decrease. English pig lead, £18 5s., 10s. decrease. Spelter, £14 3s. 9d., 10s. decrease. English block tin, £182 10s., £3 decrease. Mercury, £12 17s. 6d., 7s. 6d. increase.

Frederick Smith & Co. report, March 30th: Electrolytic copper bars, £43 10s., £1 7s. 6d. decrease. Ditto, ditto, wire rods, £48 10s., £1 7s. 6d. decrease. Ditto, ditto, h.c. wire, 7½d., ¼d. decrease. Silicum bronze wire, 8½d., ¼d. decrease.

Edward Till & Co. report, March 30th: India-rubber, Para fine, 5⅝d., ⅜d. decrease.

Trade Announcements

The Synchronome Co., Ltd., announces that from April 25th its sales, contracts, service and maintenance departments will be at Victoria House, 117, Victoria Street, Westminster, S.W.1 (telephone: Victoria 6357-9). All the departments of the company's Clerkenwell Road Works have been transferred to its new factory, the Abbey Turret Clock Works, Mount Pleasant, Alperton, Mddx. (telephone: Wembley 4667), where considerable extensions have been made and additional plant installed.

Mr. D. L. Chittenden, electrical contractor and radio engineer, has opened new premises at 61, The Broadway, Chesham, Bucks. The new premises include a demonstration room, radio repair room, stores, offices and electrical repair department.

The Trix Electrical Co., Ltd., has removed to 218, Great Portland Street, W.1 (telephone: Euston 5471-2).

The Record Electrical Co., Ltd., has removed its London office to 28, Victoria Street, Westminster, S.W.1 (telephone: Abbey 5148).

H.M.V. Household Appliances have moved to 104, New Bond Street, London, W.1. The telephone number is unaltered.

The Ideal Home Exhibition

The *Daily Mail* Ideal Home Exhibition will open at Olympia, London, next Tuesday, and will continue until the end of the month.

Orders Recently Booked

British Insulated Cables, Ltd., has completed a contract for 104 miles of 66-kV single- and double-circuit overhead power transmission line in the Malakand district of the North-West Frontier Province of India. The line is of copper supported on lattice towers, with an average span of 750 ft. The official opening by the Viceroy has been fixed for April 27th. The company has received an order from the Western United Provinces Electric Power and Supply Co., Ltd., United Provinces, India, for 60 miles of 37.5-kV overhead line on lattice steel towers, and nine h.v. sub-stations. The work, which has to be completed in twelve months, is in connection with the Etawah electrification scheme, which will supply Shikohabad, Jaswantnagar, Sirsaganj and Etawah. The company has also obtained a contract for the supply and laying of 8 miles of 3.3-kV cables for the Tata Iron and Steel Co., Tatanagar. An important feature of the order is the short time allowed for completion, as the cables have to be made, shipped, laid, jointed and put into service within twenty weeks.

In connection with the electrical work being carried out at H.M. Naval Base, Singapore, W. T. Henley's Telegraph Works Co., Ltd., is supplying, erecting and jointing over 8,000 yds. of l.v., 4-core, paper-insulated cable, also Reyrolle switchboards, power distribution fuseboards and "Artic" lighting distribution fuseboards. In addition, the contract includes the supply and installation of numerous lighting points, wall sockets and lamp fittings, complete with earthing.

Trade Commissioner for Jamaica

It is announced that Mr. S. A. Deacon, of the Department of Overseas Trade, has been appointed H.M. Trade Commissioner in Jamaica in succession to Mr. C. M. Pickthall, who has reverted for duty at the Department. Mr. Deacon expects to arrive at Kingston, Jamaica, on or about April 10th.

An Ex-Apprentice Register

For many years the British Thomson-Houston Co., Ltd., has devoted much attention to the training of young engineers, and it has now issued a book containing the names of many of those who started their engineering careers in the works of the company. Its contents include an alphabetical register of ex-apprentices and ex-testers, names of ex-apprentices in chronological order, a register of ex-apprentices according to geographical distribution of residence, and a list of ex-apprentices and ex-testers (listed in finishing year of the course) for whom no address is available. The register will serve not only to remind ex-apprentices of the friends of their training years, but will enable them to get into touch with each other.

New Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A 36-page illustrated catalogue of photo-electric cells and relays. The company has also issued an 80-page illustrated catalogue of industrial lighting fittings and accessories.

Cement & Concrete Association, 52, Grosvenor Gardens, London, S.W.1.—Two illustrated booklets, "Modern Factories in Concrete" and "Air Raid Shelters."

A. Cohnreich, 157, High Road, Tottenham, London, N.15.—A leaflet dealing with terminal strips.

Bakelite, Ltd., 63, Victoria Street, London.—A copy of "Bakelite Progress," in which is illustrated bakelite applications in the form of fan casings, convector casings, housings of vacuum cleaners and radio receivers.

British Insulated Cables, Ltd., Prescot.—A leaflet giving details of "Pernax" insulating material.

Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2.—Technical details of long-wave commercial telegraph receivers, and a short-wave aerial feeder jack field unit.

Crossley Brothers, Ltd., Openshaw, Manchester, 11.—A copy of the "Crossley Chronicles," giving details of the first direct-reversing Diesel locomotive.

Simplex Electric Co., Ltd., Broadwell Place, Oldbury, Birmingham.—A new complete catalogue of iron-clad switch- and fusegear. Also a copy of a new periodical publication called "Development News"; and a catalogue of "Creda" water heaters.

Griffin & Tatlock, Ltd., Kemble Street, London, W.C.2.—A specification card relating to the "Microid" balance damper.

Time Switches & Instruments, Ltd., 120, Victoria Street, London, S.W.1.—Leaflet relating to a time switch for poultry farms and an insulation tester with a d.c. generator and precision ohmmeter.

A. J. Balcombe, Ltd., 52/58, Tabernacle Street, London, E.C.2.—Details of the "Crosley Savamaid" electric washer.

Rhodes, Brydon & Youatt, Ltd., Waterloo Engineering Works, Gorsey Mount Street, Stockport.—Details of the "Mopump" in small sizes.

T.M.C.-Harwell (Sales), Ltd., 233, Shaftesbury Avenue, London, W.C.2.—Illustrations of the range of T.M.C. clocks.

Hackbridge Electric Construction Co., Ltd., Walton-on-Thames.—Details of current-limiting reactors.

Imperial Smelting Cpn., Ltd., 95, Gresham Street, London, E.C.2.—A well-produced and profusely illustrated art booklet on "Zinc-base Alloy Die Casting Development."

Normand Electrical Co., Ltd., 3, North Side, Clapham Common, London, S.W.4.—An unusual circular in continuous strip form describing "Nero" motors.

Mayor, Newman & Co., Ltd., 51, Farringdon Road, London, E.C.1.—A leaflet illustrating toasters, irons, &c.

John Steel, Clyde Street Mills, Bingley.—A leaflet dealing with "Impetus" electric grinders.

Private Arrangements

F. E. Wellum, radio and electrical engineer, 110, High Street, Hornchurch, Essex.—The creditors met recently, when the statement of affairs showed ranking liabilities of £2,502, and in addition there were fully secured creditors for £243. The net assets were £804, leaving a deficiency of £1,698. A resolution was passed adjourning the meeting for seven days to enable an informal committee to negotiate with the debtor and his friends with a view to obtaining an offer of composition which would be acceptable to the general body of creditors.

Bankruptcy Proceedings

J. H. Dollittle, 35, Queens Road, Farnborough, Hants, radio engineer, lately 145, Victoria Road, Aldershot, trading as the Zenith Radio Manufacturing Co.—This debtor filed his own petition and according to the statement of affairs which he has lodged there are gross liabilities of £1,680 of which £1,649 is expected to rank for dividend, with net assets of £253, leaving a deficiency of £1,396. The debtor attributes his failure to bad debts caused through hire-purchase defaulters.

F. F. C. King, 235, Banbury Road, Oxford, and 55, High Street, Oxford, 87, St. Aldates, Oxford, and 226, Cowley Road, Oxford, radio trader.—The adjourned public examination was held recently at the County Hall, Oxford, when it was reported that the statement of affairs disclosed gross liabilities of £5,621, of which £3,263 was expected to rank, and net assets of £912, leaving a deficiency of £2,351. The Official Receiver pointed out that a proof had been lodged for £1,056, whereas debtor had given the amount as £650. This increased his deficiency by another £400. Debtor, who first became aware of his position in December last when he was pressed by creditors, attributed his failure to lack of capital, the loss of agencies, and the cost of maintaining hire-purchase sales. He admitted that he was never really able to ascertain from his books the true financial position. The examination was adjourned.

R. Terrell, electrical apparatus manufacturer.—This debtor, who failed in March, 1937, applied on March 22nd at the London Bankruptcy Court for an order of discharge. The Official Receiver reported that the liabilities amounted to £650, and the assets consisted of shares in respect of which nothing was expected to be received. The debtor had been concerned in and acted as a director of electrical companies, and attributed his failure to liability under a judgment in legal proceedings instituted by one of their number. The discharge was suspended for four months.

H. J. M. Rawlinson, radio service engineer, 77, The Grove, Southend-on-Sea.—Receiving order made March 15th on a creditor's petition. First meeting April 1st at 29, Russell Square, W.C. Public examination April 13th at the Petty Sessions House, Southend-on-Sea.

N. Hall, wholesale and retail radio dealer, trading as Hall & Co. at 66, Margaret Street, Ashton-under-Lyne, and as Horners at 273, Stamford Street, Ashton-under-Lyne.—Last day for receiving proofs for dividend April 1st. Trustee, Mr. F. E. Bendall, 31, Lloyd Street, Manchester.

R. M. Jones, radio dealer, 40, Lordship Lane, East Dulwich, S.E.22.—Receiving order made March 15th on debtor's own petition. First meeting March 29th and public examination May 5th, both at Carey Street, W.C.2.

H. L. A. Wines, radio engineer, King Street, Yeovil.—Public examination May 12th at the Law Courts, Yeovil.

G. L. Branford, radio and electrical engineer, 68, Margate Road, Ramsgate.—First and final dividend of 2s. in the £, payable March 26th at 1, The Parade, Canterbury.

W. F. Hurry (Bijou Portable Radio Co.), 157, Junction Road, Highgate, N.19.—Discharge suspended for nine months until November 24th, 1938.

L. A. W. Steinmetz, electrical dealer, 56, Bromham Road, Bedford.—First and final dividend of 3s. 2d. in the £, payable March 29th at 6, The Parade, Northampton.

J. E. Madden, wireless dealer, 113, Bradford Road, Huddersfield.—Second and final dividend of 1s. 11d. in the £, payable March 31st at 23, John William Street. Huddersfield.

A. Reid, radio specialist, 1, Bridge Street, Neston, Chester.—Receiving order made March 21st on debtor's own petition.

Company Liquidations

E. W. Harris & Co., Ltd., neon lighting engineers, 28, Gerrard Street, London, W.C.2.—At the statutory meeting of creditors held recently at the Incorporated Accountants Hall, Victoria Embankment, London, W.C., it was reported that the unsecured creditors' claims amounted to £720. The assets consisted of book debts, £293; office furniture, £26; and stock, at cost, £700. The company was formed in August, 1935, and had a paid-up capital of £1,450. It was formed to exploit a neon lighting system, but considerable difficulty was experienced in the early stages and losses were sustained. Recently creditors had been pressing and there was no alternative but for the company to go into voluntary liquidation. The shareholders had nominated Mr. F. R. Hopkins, I.A., of Blakemore, Elgar & Co., 9, King's Bench Walk, London, E.C., as liquidator of the company, and that appointment was confirmed by the creditors, a committee of inspection being also appointed.

British Electric Domestic Appliances, Ltd., Kingsway, Waddon, Surrey.—A meeting of creditors was held on March 25th at the Holborn Restaurant, London, W.C. A statement of affairs as at March 12th last was presented which disclosed ranking liabilities of £35,342, all due to unsecured creditors. The net assets were £6,843, leaving a deficiency, as regarded the creditors, of £28,498. The company was incorporated in December, 1931, with a nominal capital of £2,000, divided into shares of £1 each, all of which were issued for cash. The object of the company was to manufacture vacuum cleaners and for a time it traded very successfully. In 1935 it commenced manufacturing refrigerators and in 1936 electric washing machines. In 1937 a substantial loss was incurred, and efforts were made to obtain fresh capital to reconstruct the company. On February 23rd last a debenture for £2,500 was issued for cash. A receiver had been appointed on behalf of the debenture holders. The voluntary liquidation of the company was confirmed, with Mr. C. Latham, of 185/188, High Holborn, London, W.C., as liquidator, whilst a committee of five of the creditors was also elected. The following are creditors:—Assurance Finance Trust, Ltd., £15,452; C.A.V.-Bosch, Ltd., £5,505; Crompton Parkinson, Ltd., £488; A. Preen & Co., £445; Wilkes Bros. & Greenwood, Ltd., £1,394; W. A. Williamson, Ltd., £500.

Webb & Taylor, Ltd., 122, West Green Road, London, N.15, and 649, High Road, London, N.17, radio dealers, &c.—The statutory meeting of creditors was held recently at the Institute of Chartered Accountants, Moorgate Place, London, E.C. The statement of affairs disclosed liabilities of £1,223, all due to unsecured creditors. The net assets were £476, leaving a deficiency, as regarded the creditors, of £747. It appeared that the creditors of the company had met previously, when an offer was put forward. That offer, however, was not acceptable to all the creditors, and the company had no alternative but to go into liquidation. The shareholders had met and passed a resolution nominating Mr. Stokes, of Stokes, Lee & Co., Holland Park Road, London, W., as liquidator. The meeting terminated without any definite resolution being passed, and the voluntary liquidation of the company will, therefore, be continued, with Mr. Stokes as liquidator.

Electrical Equipment & Carbon Co., Ltd.—Meetings April 25th at 45, London Wall, E.C., to receive an account of the winding-up by the joint liquidators, Messrs. C. C. Lyon and C. J. Maples.

Rapid Electric Arc Welding & Metals Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. R. Burne, 51, North John Street, Liverpool.

Welwyn Wireless, Ltd.—Meeting April 19th at 12, Old Square, Lincoln's Inn, W.C.2, to receive an account of the winding up by the liquidator, Mr. R. E. G. Woodman.

Halson Radio Co., Ltd.—Meeting April 19th at 36a, Bruton Place, W.1, to receive an account of the winding-up by the liquidator, Mr. G. Wallett.

Armstrong's Radioelectric Service, Ltd.—Winding up voluntarily. Liquidator, Mr. C. Latham, 185-188, High Holborn, W.C.1.

The Laundry Exhibition

CLEANLINESS and electricity can be said to be practically synonymous. That is why, at the International Laundry and Allied Trades Exhibition now being held at the Royal Agricultural Hall, Islington, it is difficult to find apparatus which does not employ electricity for some purpose or other. On all the latest machines electric drive, in the majority of cases by means of built-in self-contained motor units, has been adopted universally, and since the last exhibition four years ago there has developed a marked preference for electrical methods of control.

The measuring of the hot and cold water, soda and blue solutions; the filling, starting, stopping and emptying, and the operation of various visible and audible alarms are, for example, all carried out automatically by means of the "Newbery" patent control as installed on the "Amazon" washers shown by James Armstrong & Co. An ingenious feature of this system is that any number of different cycles of processes (for, say, table linen, woollens, &c.) can be immediately carried out by inserting in the controller one or another different plates, on which the connecting plugs have been set up in the required arrangement. Easy installation, quick adjustment and extreme flexibility are outstanding features of a control system of rather a different type, the "Electra," demonstrated by Marshall Hunt & Partners.

For the periodical reversing of the washers every few seconds the Lightburn patent mechanical clutch gear seems much in evidence, and we noticed it on many different makes of machines, including those of Manlove, Alliott & Co., Thos. Bradford & Co., and John Brown & Partners, (Peckham). Quite another system is now being introduced on some of the "Ibis" machines of Isaac Braithwaite & Sons (Engineers) which incorporate a new type of electric reversing gear. A 1½-h.p. 920-r.p.m. reversing motor is used for a "Wacker" combined washer and hydro-extractor (Petri Bros.), a separate 5-h.p., 1,410-r.p.m. motor operating the latter. A third motor (½-h.p., 2,800-r.p.m.) drives a blower for introducing hot air during drying.

The use of stainless steel troughs and the elimination of all corners have considerably improved the "Karntshrink" woollen washing machine shown by Hill & Herbert, and a general advance in design is noticeable in the comprehensive displays of equipment on the Baker Perkins and Cherry Tree stands.

Unloading large hydro-extractors has always been a laborious and somewhat slow operation. Welcome, therefore, is the "Autolift" machine (Watson Laidlaw & Co.) which enables a large machine with consequent large output and relatively small floor space to be used without unloading drawbacks. In "hydros," as with all the equipment shown, every precaution is taken for electrical and mechanical safety, and various devices such as D. & J. Tullis use on their machines are everywhere conspicuous. Apparently manufacturers have not yet made up their minds whether this type of apparatus should operate horizontally or vertically. Among those of the latter type we noticed a new model by J. J. Lane. All the drying cabinets on view are fitted with electric fans, and Daniel Henderson are supplying some of their models with electric heater units. Tumblers are still a popular means of drying, and the "Ibis" machine has been redesigned and recirculation incorporated. The Wardle continuous driers can now be fitted with a waste heat reclaimer.

Ironing Machines

A new type of electric drive with electric roller raising gear is used on the 120 in. by 24 in. Manlove "Super GW" ironer, and all the Armstrong "Amazon" roller ironers except the smallest single-roll machine are electrically driven through fluid flywheels at variable speeds. Among the smaller machines, several of the Lister patent swivel "Gladirons" have electrically heated tables, and much manual labour is obviated by the new Hill & Herbert "Easislyd" electric hand ironer, which can be raised or lowered by a foot treadle. The same object is achieved in a different way by the new "Hawkeye" revolving electric iron demonstrated by the British Laundry Machinery Co., which is attracting a considerable amount of attention with another new product, the "Foldrite" folding machine for table napkins, towels, &c. Various electrically operated "Simplicitas" machines for finishing dress shirts, &c., are shown by H. C. Wells & Co.

Among special apparatus for dry-cleaning work, equipment for deodorising and solvent recovery or clarifying, is of particular interest, and examples are to be seen on the stands of Solvent Recoverers, Lang-London, Thos. Broadbent, and Sutcliffe, Speakman. Other noteworthy dry-cleaning plant is shown by John Stewart & Co. and Henius.

The new "Fantom-Fast" way of marking articles is demonstrated by the National Marking Machine Co. The marks, which can be any size, are made with a fluorescent substance which is visible only under ultra-violet rays. The National Co. also supplies a photo-electric counter, and a photo-electric relay is used for stopping a packing-room conveyor made by A. L. Marshall (Carlton). Electric clocks and time recorders are shown by the National Time Recorder Co.

For delivery work Midland Vehicles are demonstrating a "B.20" chassis fitted with a body in section and incorporating the company's new air dash-pot delayed action foot controller.

The exhibition closes on April 6th.

Electricity Supply

Lighting, Domestic, Power

Ashton-under-Lyne.—LOANS.—Application has been made by the Town Council for sanction to loans of £20,000 for consumers' apparatus and £5,000 for assisted wiring.

Bolton.—SODIUM LIGHTING.—The Lighting Committee has decided to proceed with the installation of sodium electric-discharge lamps in various thoroughfares at a cost of £1,975.

Boston.—LOWER FIXED CHARGES.—The Boston & District Electric Supply Co., Ltd., announces that as from April 1st, 1938, the minimum area under Scale 2 (all-in tariff) will be reduced from 800 sq. ft. (16s. per quarter), to 600 sq. ft. (12s. per quarter). The area will be graded in 50 sq. ft. steps as before.

Cardiff.—A NEW POWER STATION?—At a meeting of the Electricity Committee on Monday the city electrical engineer (Mr. W. Jones) stated that he had every reason to believe that the

Two recent B.T.H. industrial lighting installations in the Midlands referred to on page 480

Central Electricity Board was favourable towards the construction of a new power station in the area. If the Board agreed to the Corporation's scheme for a new station it might be possible to generate two or three times as much as was required for the city's needs, in which case it would be possible to supply other districts. At the moment production at Roath power station was about 50 per cent. of capacity. Consumption was increasing, but the extra power was imported from the grid. This was no loss to the undertaking and did not affect the cost to the consumer, but meant that employés were standing off for one shift. According to the *Western Mail*, it is understood that two schemes are under consideration—one for providing a new 30,000-kW generator at the existing station and the other for a new station on a site not yet mentioned.

Dover.—CHEAPER STREET LIGHTING.—The Town Council has decided to reduce the charge for public street lighting from 2¼d. to 2d. per kWh from April 1st. It is stated that the loss of revenue will amount to about £660. The charge for energy used for floodlighting is also to be modified, enabling the Castle illuminations to be improved.

Ealing.—SUB-STATION.—The Electricity Department is to erect a sub-station in Cavendish Avenue.

Exeter.—POWER STATION SWITCHGEAR EXTENSION.—The Electricity Committee is to put in hand immediately the following extensions to the main 6,600-V switchgear at the power station:—One 800-A circuit-breaker complete with all instruments and protective gear for the Exe Valley Electricity Co.'s new feeder; one 600-A circuit-breaker complete with all equipment for the Corporation's new Heavitree Gallows sub-station feeder and one new bus section unit.

Folkestone.—OVERHEAD LINES.—The Folkestone Electricity Supply Co. is to erect overhead lines in Crete Road West.

France.—ELECTRIC COOKING.—A recent report reveals that at September 30th last there were 196,484 electric cooking appliances in service in France and North Africa (including 55,422 hot-plates, 84,050 ranges, and 21,246 ovens) as compared with just over 160,000 a year before and 31,000 in 1932. These appliances represented a connected load of 602,619 kW. Commercial installations numbered 33,048. Of these 1,382 were in restaurants, whereas two years previously there were only 422 restaurants with electric cooking installations. An interesting development in rural districts is that combined electric and coal ranges have gained favour, electric cooking being adopted in the summer when a cool kitchen is desirable.

TOULOUSE EXHIBITION.—An exhibition illustrating the development and possibilities of electricity is to be held in Toulouse during the last two weeks in May. It is being organised by a committee under the presidency of Mr. Camichel, director of the Institute of Electrotechnics at Toulouse University.

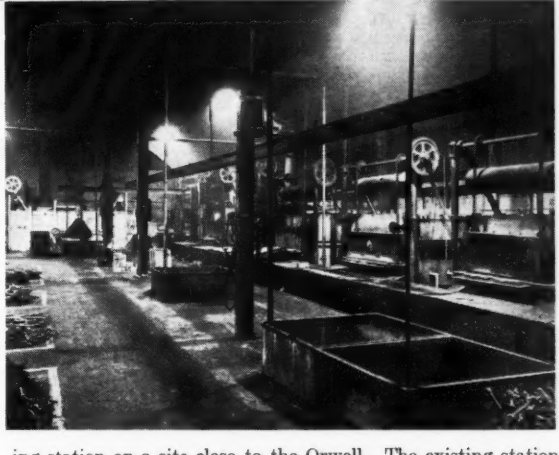
Heywood.—SUB-STATION.—The Town Council is to erect a sub-station in Fox Street.

Hull.—ALTERNATIVE SUPPLY TO DOCKS.—The city electrical engineer, in conjunction with the Central Electricity Board, is preparing a scheme for an alternative supply of electricity to the docks.

India.—ELECTRICITY FOR BENARES.—Our Bombay correspondent reports that the Municipal Board of Benares has prepared a scheme for generating and supplying electricity in the city which is estimated to cost Rs.15,00,000. The scheme has been submitted to the Government of the United Provinces and is awaiting sanction. It is supported by the Commissioner of the Benares Division.

THE PAPANASAM HYDRO-ELECTRIC PROJECT.—The Government of Madras has now made public the full details of the Papanasam hydro-electric project. The initial capacity will be 18,000 h.p., and ultimately there will be provision for a maximum effective output of 30,000 kW. The project will complete the first stage of the Madras grid as outlined by the Electricity Department. The total expenditure in the first year of operation is estimated to be Rs.179 lakhs, rising to Rs.258 lakhs in the tenth year. Of this, works amounting to about Rs.21 lakhs have already been constructed. It will be necessary to build a 176-ft. dam on the Tambraparni River just below where it is joined by the Kariar. The reservoir will have a storage of 5,500 million cu. ft. Lower down the river a diversion weir will be constructed near the head of the Papanasam Falls to provide for a regulating reservoir of 28 million cu. ft. The power house will be a short distance from the Papanasam Falls, and the gross head will be 330 ft. Three generating units, each of 9,000 h.p. maximum rating, will be installed initially and two more units later. When the demand increases beyond the capacity of the hydro-electric station a steam station will be built.

Ipswich.—NEW POWER STATION.—The Electricity Committee recommends that consulting engineers shall be appointed to prepare a scheme for the establishment of a new generating station on a site close to the Orwell., The existing station cannot be extended, and the Committee favours the establishment of a new station on a site for which an option has now been obtained.



Littleborough.—SUB-STATION.—The Urban District Council proposes to erect a sub-station at Shore Mill.

London.—J.E.A.'s ESTIMATES.—The estimates of income and expenditure for 1938 submitted by the London and Home Counties Joint Electricity Authority allowed for a deficiency of over £120,000 for the year, making the total deficit about £195,000, apart from an item of £40,000 contingent liability for local rates. The Authority did not anticipate that there would be an annual balance on the credit side until 1942, and it did not expect the accumulated deficit to be wiped out until 1946, or, if liability to rates were taken into account, even later. The Electricity Commissioners expressed dissatisfaction with the estimates, and asked the Authority to revise its estimates in an endeavour to secure equilibrium in 1940. They maintained that "it was not their function to advise the Authority as to the precise steps which they should take." In reply to this, the chairman and vice-chairman of the Finance Committee have prepared a memorandum which has been sent to the Commissioners asking them to approve the estimates. This memorandum points out that the position is largely due to the high rate at which the Authority is redeeming its capital. By 1946-47, it is estimated, the sinking funds would amount to £3,824,000, against a total capital expenditure of £7,500,000. It is stated that inquiries are being made to see how expenses can be reduced, and in the meantime the Commissioners are asked for guidance and are requested to approve the estimates.

The Walton & Weybridge Council has given notice of its intention to apply to the Electricity Commissioners and the London J.E.A. for powers to acquire the Weybridge portion of the J.E.A.'s area, which lies within the urban district. It is stated that the consumers in this area are charged considerably more for their electricity than are residents in Walton, which is served by the Council's undertaking.

Hammersmith.—Owing chiefly to the substantial increase in the price of coal the net loss in respect of the financial year 1938-39 was estimated at approximately £21,560, but the Electricity Committee proposes to reduce this to £8,332 by altering from 15 to 12½ per cent. the rebate which applies to certain tariffs for the supply of electricity, and also to the charges for the hire of lighting and heating installations provided under the assisted wiring scheme.

Manchester.—New Generator at Barton.—Work on the new 50,000-kW turbo-generator at Barton has now been finished, and this completes the £5,500,000 Barton power station scheme of the Manchester Corporation. There will be a formal opening ceremony on May 10th, to be performed by Sir Leonard Pearce, the chief engineer of the London Power Co., who, as chief engineer of the Manchester Electricity Department, originated the scheme.

Margate.—Strip Lighting to be Retained.—The Town Council has decided not to discontinue the decorative strip lighting, although it was reported that this would be the only way of reducing expenditure.

Middleton.—Sub-station Equipment.—Application is being made by the Town Council for permission to borrow £5,000 for sub-station equipment.

Midlands.—Industrial Lighting.—Among recent examples of improved industrial lighting by the B.T.H. Co. are those at the works of Bradley & Co., Bilston, and the Smethwick Drop Forgings Co., Ltd., in which different problems were encountered. In the former the large quantities of galvanised goods and the comparatively low mounting height of 12 ft., which was unavoidable, demanded careful treatment. Fourteen 250-W "Mercra" lamps in "Mazdalux Distributing" reflectors, staggered at 15 ft. spacing, give a uniform illumination of about 8 ft.-candles. The reflecting factor of the stacked goods enhances the effect considerably, and, though the photograph (p. 479, left) seems to suggest the existence of a slight amount of glare, it is not at all apparent in reality. In the iron plate shop of the same firm four similar units at 13 ft. mounting height give a working intensity of 12 ft.-candles. The road leading to the works is lighted by 400-W "Mercra" lamps in angle fittings except for one "Dilen" lantern. In the forging's inspection shop at the Smethwick Drop Forgings Company's works (right-hand illustration), four 400-W "Mercra" lamps in "Mazdalux Dispersive" reflectors, mounted at a height of 19 ft., give an intensity of approximately 12 ft. candles. The new method gives a very even illumination with no hard shadows. Seven similar units, but with 250-W lamps mounted at a height of 15 ft. give an intensity of about 10 ft.-candles in the forgings heat-treatment shop.

Newcastle-on-Tyne.—Sub-station.—Plans have been approved for a sub-station in Brandling for the North-Eastern Electric Supply Co., Ltd.

Palestine.—Supply for Gaza.—Gaza, where Samson performed his gate-carrying feat, is to have a municipal electricity supply, a contract having been made with the Palestine Electric Corporation, Ltd. A feature of the agreement is that the parties are an Arab Town Council and a Jewish Company—showing that electricity can overcome racial antagonism.

Poole.—Submarine Cable.—The Bournemouth and Poole Electricity Supply Co., Ltd., is to lay a high-voltage submarine cable from the mainland to Round Island.

Preston.—Electric Cranes.—Referring to future developments at the Preston docks, the Chamber of Commerce states in its annual report that arrangements are being made for the purchase of electrically operated cranes. This will be the commencement of a general scheme of electrification, which will proceed as and when new cranes are required.

Slough.—Electricity in Council Houses.—A sum of £100 per annum is to be spent by the Urban District Council in installing a power point in each Council house not already provided with one, at an estimated cost of 7s. 6d. each.

Stafford.—New Equipment.—To provide for the increased demand for current in the Queensville area the Electricity Committee proposes to erect a sub-station with equipment at a cost of £4,343. It is further proposed to proceed with modifications and additions to the extra-high-voltage control switchboard at the main station at a cost of £946 and with the installation of additional switchgear at the English Electric Works sub-station at an estimated cost of £1,290. The Committee has also decided to apply for sanction to borrow £20,000 to cover prospective expenditure on mains and services.

Staveley.—Street Lighting.—The Urban District Council is to send a deputation to West Bridgford to view the sodium lighting recently installed in one of the main thoroughfares of the town.

Stoke-on-Trent.—Change-over.—The Electricity Committee is to change over the Market Street area, Longton, at a cost of £3,000.

Sub-station.—Approval has been given by the Electricity Committee with regard to the equipment of the sub-station proposed to be erected on the site already purchased at Hadderidge, Burslem, at a cost of £3,825.

Sunderland.—Cheaper Street Lighting.—The Electricity Committee proposes to reduce the charge for street lighting, representing a concession of about £2,000 a year.

Tasmania.—Supply in Launceston.—Mr. R. J. Strike, the city electrical engineer of Launceston, reports that hydro-electric power generated and purchased by the Electricity Department in the year ended June 30th last totalled 19.5 million kWh, an increase of 5 per cent. (16.9 million kWh sold). Averaged over the population of 33,000, the sales other than for street lighting and tramways were equivalent to 449 kWh per inhabitant. Apparatus connected at the end of the year included 2,458 motors, 5,909 irons, 3,747 radiators, 676 cookers, 779 water heaters and 4,416 miscellaneous appliances. The Department's revenue increased by £13,339 to £99,848, and the net surplus was up by £5,397, to £22,289. The average price received per kWh sold was 1.185d.

Turkey.—Progress of Industrialisation Plan.—The British Chamber of Commerce in Turkey makes reference in its annual report for 1937 to the prospect of the Government's policy of controlling industry and public utility enterprises being extended to embrace even commerce itself. The Government's industrialisation plan is proceeding steadily. Of the factories which were to have been built between 1933 and 1938 eleven are now in full operation and others are in course of erection. Among orders placed in the U.K. was one secured by the Marconi Co. for the construction of long- and short-wave broadcast transmitters and studios at Ankara. Turkey has a large programme in view, including schemes for the electrification of extensive areas in Asia Minor, which are intended to be carried out in the second five-years' industrial plan. The construction of electric power-houses at Tchatal Agzi (near Zonguldak) is one of the first schemes to be undertaken, and subsequently electrical works are projected for Kutahya for the supply of electricity to the towns of Eski Schir, Bursa, Izmir and, in general, to Western Anatolia. The fuel to be used is lignite, of which large quantities are available.

Tynemouth.—Sub-station.—The Town Council proposes to erect a sub-station near Preston North Road to cost £1,500.

United States.—Water Power Negotiations with Canada.—*Reuter* reports from Washington that the U.S. Government has reiterated its willingness to enter into an agreement with Canada for the general development of power in the Great Lakes area. This is revealed in a note sent by Mr. Cordell Hull, U.S. Secretary of State, to the Canadian Government. The Note shows, however, that America has rejected the recent Canadian project for diverting water from Long Lake to Lake Superior and exporting the surplus power for American consumers unless it forms part of an international agreement covering the whole waterways scheme. Mr. Hull, in a Memorandum issued with the Note, says that the importation of power from Canada is undesirable unless it is accompanied by development of an equal amount in the United States, as many of the most necessary industries in times of national emergency require large and uninterrupted supplies. President Roosevelt recently told a Press conference that he objected to the importation of power from Canada because it could be shut off suddenly in time of war, and might raise embarrassing problems of neutrality.

Warwickshire.—Extensions.—The Shropshire, Worcestershire & Staffordshire Electric Power Co. proposes to carry out extensions to Ratley, Edgehill and Radway.

Yoxford (Suffolk).—No Overhead Lines.—In response to requests from the County Highway Committee and the Blyth Rural District Council, representatives of the East Anglian Electric Supply Co., Ltd., at a meeting of the East Area Joint Planning Committee agreed to eliminate overhead lines at Yoxford, which was described as the garden of Suffolk, and to lay the cables underground. The additional cost was estimated roughly at £600.

Communications

Great Britain.—Cable to Bute.—A further improvement in the telephone facilities in the West Coast of Scotland is to be brought about by the laying of a new submarine cable between the island of Bute and Argyll.

Greece.—New Athens Broadcasting Station.—King George of Greece has inaugurated the new 15-kW Athens broadcasting station by an Address to the Nation on the anniversary of Greek independence from Turkish rule. The new station operates on a wavelength of 499 metres.—*Reuters* (Athens).

Eire.—Provision of Radio Apparatus in Lifeboats.—Radio apparatus is to be installed in all the big lifeboats in Ireland. An announcement to this effect was made by the secretary of the Lifeboat Institution at the annual meeting of the Institution on March 23rd.

Jamaica.—Proposed Radio Station.—A *Reuter* message from Kingston states that Jamaica is expected to have a broadcasting station by the end of the year, the Governor having made an announcement to this effect in his speech at the opening of the Legislature.

Sweden.—New Motala Short-wave Transmitter.—*Reuter's Trade Service* reports from Stockholm that the present 0.75-kW short-wave transmitter of the Motala broadcasting station is to be replaced by one of greater power which, it is hoped, will be finished before the Delaware celebrations begin next June.

Traction

Glasgow.—NEW ROLLING STOCK.—A proposal of the Transport Committee to borrow £1,000,000 to finance the purchase of new tramcars, buses and underground rolling stock and extension of services has been approved by the Council.

This scene at Queen's Street, Belfast, augurs well for the success of the new trolley-bus system

Japan.—WATER-POWER FOR ELECTRIC RAILWAY.—A Tokyo correspondent reports that full electrification of the Tokaido line is brought nearer with the completion of the Shinano River hydro-electric generating plant, the first unit of the Government Railway's power plant which was originally scheduled to be completed in 1940. Work on the second unit will be started at once, and judging from recent experience it is believed that this will be finished within the next fiscal year. A problem of long standing—the electrification of the Tokaido line—will then become a reality, and an important step in electrical matters in Japan will have been taken. The Shinano scheme was first decided on nearly twenty years ago, but had to be postponed because of the 1923 earthquake and fire. It was launched in April, 1931. The main dam is at Kainomura, on the upper reaches of the river, from whence the water is led through concrete conduits to a filter reservoir, then by two pressure pipe lines to another dam which regulates the flow, and so to the Chite generating plant. Especially noteworthy are the 25 km. of extending waterways, the hexagonal filter reservoir 353 m. long and 121 m. wide, and the regulating dam. When the second project (leading the water from the Chite plant to the Yamanabe plant) is completed the total generating capacity will reach 1,105,000 kW. This power will be transmitted to the Musashino sub-station, and after being transformed to 6,600 V will be distributed throughout the entire system along with the additional power from the Akabane and the Kawasaki plants. When the whole project is finished the contract with the Tokyo Electric Co., which has been furnishing most of the power, will be cancelled.

Northern Ireland.—INAUGURATION OF TROLLEY-BUS SYSTEM.—Transport officials from many parts of Great Britain witnessed the inauguration of Belfast's trolley-bus system by the Lord Mayor (Sir Crawford M'Cullagh) on Monday. Sir Crawford brought the tramcar service on the Falls Road to a stop by driving the last car on its final journey. He then drove the first new trolley-bus.

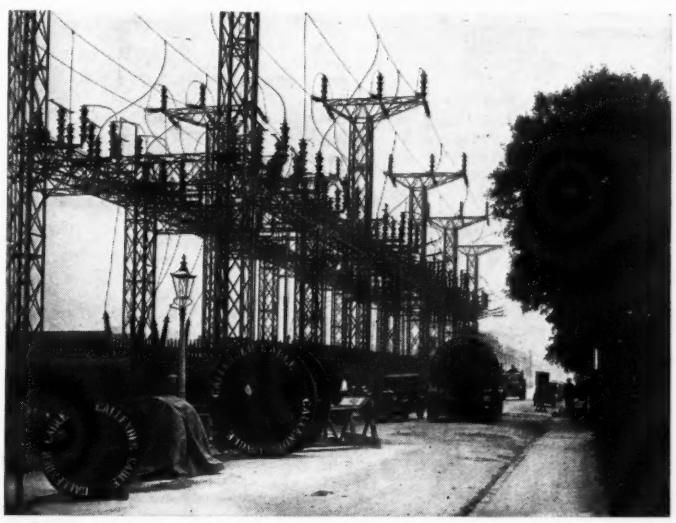
Southend-on-Sea.—COUNCIL PERSEVERES.—It was reported at a recent meeting of the Town Council that the question of electrifying the railway to Fenchurch Street had again been raised with the L.M.S. Company. Ald. Miles stated that whenever an opportunity occurred the matter was brought forward, and that when L.M.S. officials were at Southend recently in connection with another matter the need for electrification was urged. Ald. Johnson said that the town would never progress until they had an electrified railway. Ald. Hockley thought people nowadays were getting electrically minded and were choosing places to live that were served by electric trains. Other speakers did not mind whether the trains were steam or electric so long as the service was improved.

Southern Railway.—PROGRESS OF ELECTRIFICATION SCHEMES.—It is reported in *The Times* that the electrification of the alternative route to Portsmouth, *via* Horsham, Arundel, and Chichester, and of the Littlehampton and Bognor branch lines is almost complete, and the electric train service will be started on July 5th. Rapid progress has been made with the first section of the new line from Motspur Park to Chessington, and it will be opened on May 28th. In the first section there are two new stations—Malden Manor and Tolworth—and a new service of trains from Waterloo to Tolworth will relieve the trains from Waterloo to Epsom and Leatherhead *via* Motspur Park. The building of this line has involved some engineering difficulties, including nine bridges over public roads and a 140 ft. viaduct across the Hogsmill River.

Extensions to the Grid

AN extension of a 132-kV primary grid line, from Leicester to Corby (26 miles), has recently been completed by Callender's Cable & Construction Co., Ltd., which is now engaged on another line of twenty-eight miles from Runcorn to Mollington (Chester), Oxton (Birkenhead).

For the Leicester-Corby line, double circuit with both circuits strung, considerable difficulty was experienced with foundations owing to much of the route running over waterlogged ground. Pumping was necessary at eighty-nine positions and close timbering of excavations at ninety-seven positions out of the total of 159. A specially interesting operation was the running of conductors over an existing 33-kV double-circuit secondary grid line supplying the Corby works of Stewarts & Lloyds. This line could not at any time be completely shut down, although at week-ends it was possible to make one circuit dead.



The station end of a Callender grid extension

Two tubular steel scaffoldings each approximately 30 ft. long, 10 ft. wide and 60 ft. high were erected, one on each side of the 33-kV line, and the conductors were drawn by means of ropes over the top of them. The six conductors and two earth wires in this span were successfully erected during one week-end.

Another difficulty experienced was in connection with the run-in to the Leicester sub-station. Part of the route required for the new line was already occupied by towers carrying the Leicester to Loughborough primary grid line. It was necessary to erect new towers for the latter line and to change the existing conductors on to them before the run-in of the new line could be completed. This part of the work, which also had to be carried out at week-ends, went through without a hitch and with the minimum interruption to service. The line was completed, tested and handed over in February and is now in service.

Work on the 132-kV primary grid line from Runcorn to Oxton (also double circuit, both circuits strung) was commenced towards the end of last year, and has so far been confined to foundations. One portion of the route involves the crossing of the River Weaver, using towers 160 ft. and 140 ft. in height, and the erection of a number of towers on the adjacent Frodsham Marshes. Some of these towers will be supported on reinforced concrete piles 35 ft. long and others on reinforced concrete rafts 30 ft. square. Similar difficulties will be experienced with the run-in to the Runcorn sub-station as were experienced in connection with the run-in to the Leicester sub-station for the central area contract, due to the existing Runcorn to Warrington and Crewe primary grid line.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Bath.—April 18th. City Council. Materials for twelve months. (See this issue.)

Birkenhead.—April 19th. Borough Council. Stores for twelve months. (See this issue.)

Birmingham.—April 25th. General Purposes Committee. Electric thermal storage, panel warming and plenum ventilation for proposed block of municipal offices. Town Clerk, Room 30b, The Council House (deposit £5 5s.).

Brecknockshire.—April 1st. Electric lighting and heating installation at new senior school at Crickhowell. H. C. W. Strickland, Watton Offices, Brecon.

Bridlington.—April 2nd. Town Council. 11-kV switchgear equipment, l.v., a.c. distribution panel and one 500-kVA transformer. (March 18th.)

April 11th. Town Council. Two neon signs for the Grand Pavilion and the Royal Princes Parade. (See this issue.)

Bristol.—Installation of electric wiring and equipment at Homes for Aged and Infirm, Fishponds. Edwin Hoare and Partners, 39, Broad Street (deposit £2 2s.).

Dumfries.—April 14th. County Council. Electrical work at Moffat Rest House. County Clerk, County Buildings.

Dundee.—April 6th. Electricity Department. Electric cookers, wash boilers, water heaters, a.c. meters and d.p. switches for one year. (March 18th.)

Gellygaer (Glam.).—April 2nd. Electricity Department. One electric battery vehicle and one petrol-driven vehicle. (March 18th.)

Grantown-on-Spey.—April 19th. Town Council. Complete electric street lighting installation for the town. G. C. McLean, Electricity Works, Waterloo Place, Inverness.

Heston and Isleworth.—April 2nd. Electricity Department. One 600-kVA transformer, e.h.v. switchgear, milking booster, and special l.v. testing transformer. (March 18th.)

Hoylake.—April 14th. Electricity Department. House service electricity meters. (See this issue.)

India.—Bengal.—April 26th. Bengal and North Western Railway Co., Ltd. Two motor-driven air compressors. (See this issue.)

Iraq.—April 2nd. Government. Four Diesel engines coupled direct to a.c. generators, with all accessories. Royal Iraq Legation, 22, Queen's Gate, London, S.W.7.

Kettering.—April 29th. Electricity Department. Renewal of certain plates of existing battery. (See this issue.)

Lerwick.—Town Council. Electrical work at 180 houses. A. A. Foote, architect, 108, George Street, Edinburgh.

Leyton.—April 14th. Electricity Department. One 500-kVA transformer and e.h.v. switchgear. (See this issue.)

Littleborough.—April 9th. U.D.C. Four sets of electrically driven, vertical, unchokeable, centrifugal sewage pumps, including automatic starters, switchboard and wiring. Clerk to the Council, Council Offices (deposit £2).

London.—Stepney.—April 25th. Electricity Supply Undertaking. Transformers, switchgear, distribution units and street pillars for twelve months. (See this issue.)

Manchester.—April 20th. Electricity Department. Coal-dust collecting plant for Barton power station. (March 18th.)

Mansfield.—April 12th. Meden Valley Waterworks Committee. One 460-kVA three-phase transformer for Budby pumping station and one 125-kVA three-phase transformer, e.h.v. switchboard, and m.v. switchboard for Stoney Houghton pumping station. (March 18th.)

Middlesex.—April 11th. County Council. Two X-ray units and equipment for the Redhill County Hospital. (March 18th.)

Newport.—April 21st. Electricity Department. Two water-tube boilers and accessories. (March 18th.)

New Zealand.—Wellington.—April 27th. Posts and Telegraph Department. 1,100 secondary cells. (T.Y. 19186/38.)*

May 24th. Condensers. (T. 19917/38.)*

June 3rd. 120.000 1.5-V telephone cells. (T. 19918/38.)*

April 12th. Public Works Department. 11,000-V, 400-V multicore, and telephone cable. (T. 19185/38.)*

June 28th. Public Works Tenders Board. Nine 110-kV single-phase potential transformers and accessories, and nine auxiliary transformers. (T.Y. 19187/38.)*

Portsmouth.—April 11th. Electricity Undertaking. Meter-testing equipment. (March 18th.)

April 19th. E.h.v. and l.v. sub-station switchgear and steel kiosks with sswitchgear. (March 25th.)

Shipley.—April 14th. Electricity Department. E.h.v. and l.v. cables. (See this issue.)

South Africa.—Cape Town.—April 20th. Electricity Department. House service electricity meters. (T. 19146/38.)*

Johannesburg.—April 16th. City Council. Screwed electrical conduit for twelve months. (T.Y. 19504/38.)*

April 25th. Railways and Harbours Administration. One twenty-ton electric travelling crane. (T. 19507/38.)*

Pretoria.—April 28th. Union Tender and Supplies Board. Air-conditioning plant for the East London automatic telephone exchange (Cape Province). (T. 19732/38.)*

Stockport.—April 14th. Electricity Department. Central evaporation plant, boiler feed water pumps and l.v., a.c. switchboard for auxiliary plant at Millgate sub-station. (See this issue.)

Spenborough.—April 11th. Electricity Department. One 1,250-kVA (alternatively, 1,500-kVA) transformer. (See this issue.)

Straits Settlements.—Singapore.—April 4th. Municipal Water Department. Three generating sets. (T.Y. 18864/38.)*

Swindon.—April 12th. Electricity Department. One sheet steel kiosk sub-station with e.h.v. equipment. (March 25th.)

Tiverton.—April 9th. Borough Council. Electrically driven reciprocating pumping plant and filtration plant. Town Clerk.

Uruguay.—Montevideo.—April 8th. Electricity Supply and Telephones Administration. Single, double and triple pole and rotary switches. (T.Y. 18880/38.)*

April 26th. 20,000 insulator bolts or pins. (T.Y. 19287/38.)*

April 20th. Insulators, sockets, lampholders, fuse plugs, transformers for bell installations, &c. (T.Y. 19284/38.)*

April 19th. 655 dynamometric type electricity meters. (T.Y. 19282/38.)*

April 22nd. Electric motor-operated convertor set for electric welding. (T.Y. 19286/38.)*

Wakefield.—April 4th. West Riding Public Health and Housing Committee. Electrical work at the proposed child welfare clinic at Church Road, Denaby Main, near Conisborough. Clerk of the County Council, County Hall.

April 4th. County Council. Electrical installation at Ardwick-le-Street Grammar school, Castleford Senior school, and the extensions at North Elmsall Harewood Lane Council school. Clerk of the County Council, County Hall.

Wallasey.—April 19th. Borough Council. Single-phase (indoor and street-pit type) transformers. (March 25th.)

Ware.—April 2nd. U.D.C. Electric lighting installations in thirty-eight houses. (March 25th.)

Warrington.—April 19th. Electricity Department. Transformers. (See this issue.)

West Hartlepool.—April 20th. Electricity Department. Three 300-kVA, single-phase transformers. (See this issue.)

Weymouth.—April 5th. Electricity Department. E.h.v. and l.v., p.i., l.c., and s.t.a. cable for one year. (March 18th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birmingham.—Electricity Committee. Accepted. Electric lighting installations in schools: Hatchford Brook (£810), Lea Village (£2,500), Baskerville Residential, extensions (£102).—H. Pratt. Dulwich Road, extensions (£249).—Parker, Winder & Achurch.

Great Yarmouth.—Borough Council. Accepted. Street lighting lamps for twelve months.—J. Ismay & Sons.

Heston and Isleworth.—Borough Council. Accepted. Electrical installation at the New Heston Public Baths.—Alpha Manufacturing and Electrical Co.

Ipswich.—Electricity Committee. Recommended for twelve months. Switchgear.—Ferguson, Pailin.

Kettering.—Electricity Department. Accepted for twelve months. E.h.v. and l.v. cables.—Union Cable Co. Single-phase a.c. meters.—British Sangamo; English Electric Co. A.c. prepayment meters.—Met.-Vick. Electrical Co.; Venner Time Switches.

London.—Poplar.—Contracts Committee. Accepted. Special lighting fittings for town hall (£406).—Harcourts.

Bermondsey.—Electricity Committee. Accepted. Switchgear (£741).—A. Reyrolle & Co.

L.C.C.—Housing and Public Health Committee. Recommended. Electric lighting installations in dwellings at Coventry Cross estate and the Bow Road island site, Poplar (£905).—Buchanan & Curwen.

Stepney.—Finance and Parliamentary Committee. Recommended. One group feeder switch and two feeder switches for Limehouse generating station (£4,615).—Met.-Vick. Electrical Co. One three-phase, 50-cycle, 6,600-V bank of cast-in-concrete reactors (£406).—B.T.H. Motors, fans, cutters, &c., in connection with the change-over in the Whitechapel area from d.c. to a.c. (£912).—L. G. Tate & Co. Recommended for twelve months. Electric irons.—Revo Electric Co. Electric kettles.—Bulpitt & Sons; G.E.C.

Electricity Supply Committee. Recommended. Equipment required in connection with change-over from d.c. to a.c. supply: One feeder panel (£544), bus-bar trunking (£35), and three transformers (£34).—A. Reyrolle & Co. One l.v. circuit-breaker (£173).—G.E.C. One distribution board (£94).—English Electric Co. Two 750-kVA transformers (£1,422), and parallel control for one set (£33).—Ferranti.

Stoke-on-Trent.—Electricity Committee. Accepted for twelve months. Cables and overhead transmission lines.—Callender's. E.h.v. switchgear.—Met.-Vick. Electrical Co.

Swansea.—Electricity Committee. Accepted for twelve months. Feeder pillars.—Siemens Bros. E.h.v. switchgear.—New Switchgear Construction Co. Time switches.—Horstmann Gear Co.; Met.-Vick. Electrical Co.; Venner Time Switches. Meters and demand indicators.—Ferranti; Electrical Apparatus Co.; Met.-Vick. Electrical Co.; Price & Belsham; Siemens Electric Lamps & Supplies. Indoor and outdoor transformers.—British Electric Transformer Co.; Hackbridge Electric Construction Co.; Met.-Vick. Electrical Co. Cable.—Callender's; Pirelli-General. E.h.v. cable joints.—Callender's. Cooker control units.—J. H. Tucker & Co. Copper bars, &c.—Callender's; Hudson & Wright; Lighting, Heating & Traction Supplies Co.; Santon. House service cut-outs.—B.I. Cables; W. Lucy & Co.

Notes

I.E.E. Summer Meeting

The Council of the Institution of Electrical Engineers has accepted the invitation from the Committee of the South Midland Centre to hold its summer meeting in the area of the Centre from July 4th-8th. Throughout the meeting the headquarters will be at the Grand Hotel, Birmingham. The programme arranged by the Committee is as follows, but is subject to alteration :—

Monday, July 4th.—Evening : The party will assemble in Birmingham. Informal reunion at the Grand Hotel.

Tuesday, July 5th.—Morning : Visit to the Hams Hall power station of the Birmingham Corporation and the Central Electricity Board's sub-station. Afternoon : Proceed from Hams Hall to Witton, where lunch will be provided by the General Electric Co., Ltd. A visit to the company's works will follow. Evening : Civic reception at the Council House, Birmingham. The guests will be received by the Lord Mayor and Lady Mayoress of Birmingham (Councillor E. R. Canning and Mrs. Canning).

Wednesday, July 6th.—Morning : Visit to the works of the British Thomson-Houston Co., Ltd., at Rugby. Lunch at Rugby as the guests of the company. Afternoon : Drive from Rugby by motor coach through Warwickshire, viewing Stoneleigh Abbey and Kenilworth Castle, to Warwick. Reception by the Mayor and Corporation of Warwick in the grounds of Warwick Castle. Tea and light dinner in St. Nicholas' Park, Warwick, as the guests of the Midland Counties Electric Supply Co., Ltd. Proceed from Warwick to Stratford-on-Avon. Evening : Attend the evening performance at the Shakespeare Memorial Theatre, Stratford-on-Avon.

Thursday, July 7th.—Morning : Visit to the works of the Austin Motor Co., Ltd., at Longbridge. Drive from Longbridge through Worcestershire to Stourport, where lunch will be provided at the generating station by the Shropshire, Worcestershire & Staffordshire Electric Power Co. Afternoon : Inspect the Stourport generating station, where tea also will be provided by the company. Evening : The evening will be spent at the Grand Hotel, Birmingham, as the guests of the General Electric Co., Ltd. Dancing, cabaret and buffet refreshments (evening dress).

Friday, July 8th.—Morning : Visit to Telephone House, Birmingham, followed by lunch at the Grand Hotel as the guests of the General Post Office. Afternoon : Mystery drive and tea in the country. Evening : Gala night at the Botanical Gardens, Edgbaston (including dinner and dancing), as guests of the City of Birmingham Electric Supply Department (evening dress).

Those wishing to attend the meeting can obtain application forms from the secretary of the Institution, Savoy Place, London, W.C.2.

Manchester Electrical Circle

Wiring installations in "deferred areas" in Manchester were discussed at the March meeting of the Manchester and District Electrical Circle. Complaint had been made of useful work having been done by electrical contractors in canvassing householders and booking up orders which, when submitted to the local authority, pronounced that the houses were in "deferred areas." This meant that the work could not be proceeded with. Subsequently, perhaps after the passing of several months, the property was removed from the deferred list, but the work of wiring the houses was executed by other contractors. The Electrical Circle considered this to be unfair to the contractors who made the original canvass and asked Councillor A. T. Barratt, who is an electrical contractor, to take the case up on their behalf. He did so and has now been informed that when property is on the deferred list the contractor's application will be filed for two or three months, and should the veto be lifted within that period the work will go to the contractor who made the canvass. Mr. G. M. Brewster called attention to the Manchester electrical carnival in aid of the Electrical Industries Benevolent Association. It was decided to give a prize of the retail value of two guineas. The resolution passed at a previous meeting for the wiring back of 5-A plugs, these to be regarded as one and a half points under the Manchester assisted wiring scheme, was queried. It was contended that although the wiring back of 5-A plugs was recommended under the I.E.E. Rules, it was not compulsory in Manchester. The subject will be discussed further at the next meeting of the Circle. Proposals have been made for a canvass of Manchester electrical traders to test the feeling of retailers of electrical goods on the desirability or otherwise of securing permission for shops to open on the weekly half-day holiday. Councillor A. T. Barratt said that if there was a majority in favour of this a petition would have to be presented to the City Council, but even so, there would still be the obligation on the shopkeeper to give assistants the weekly half-day holiday. Difficulties were anticipated in compiling a list of traders and in defining who were electrical retailers. However, it was decided, in view of the importance of the subject, to give members the opportunity of thinking over the situation with a view to a further discussion at the next meeting.

I.E.E. (London Students)

Arrangements have been made for the London Students' Section of the I.E.E. to visit the London television station at Alexandra Palace on April 6th and 9th. Tickets can be obtained from Mr. J. E. Ball, the hon. assistant secretary of the London Students' Section, 28, Pymmes Green Road, New Southgate, N.11.

Finsbury Technical College Old Students

The annual dinner of the Finsbury Technical College Old Students' Association will be held at the Trocadero Restaurant on April 9th, when the chair will be taken by the president, Dr. C. H. Desch, F.R.S. As usual ladies are invited to be present, and old students may obtain tickets (11s. 6d. each) from the acting hon. secretary, Mr. H. P. Guy, "Hadley," Station Road, New Barnet, Herts.

N.E.S.C.O.E. Association

The seventh annual dinner of the North-Eastern Supply Company's Old Employés will be held at 7.30 p.m. on April 7th at the Criterion Restaurant, Piccadilly, W.1, with Sir Arnold B. Gridley, M.P., vice-president, in the chair. Serving members of the company's staff will be welcomed. Tickets at 10s. each are obtainable from the hon. secretary, Mr. W. G. Bass, 506, Bush House, Strand, W.C.2.

The Characteristic Curve

We are informed by Mr. R. B. Rowson, author of the article published under the above heading in the ELECTRICAL REVIEW of March 25th that the diversity of the water-heater referred to in the penultimate paragraph should have been given at 2.5 instead of 2.25 as stated. Equations (2) and (5) should read $£=17d^{\cdot 6}$ and $£=10.7d^{\cdot 7}$, and the figures in the table on p. 420 of kWh sold for lighting and domestic use are percentages.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, April 7th. Institution, London, W.C.2. 6 p.m. "The Trend of Design of Electric Locomotives." Mr. C. E. Fairburn.

Meter and Instrument Section.—Friday, April 1st. Institution, London, W.C.2. 7 p.m. "Some Polarisation Phenomena in Magnetic Materials, with Special Reference to Nickel-Iron Alloys." Mr. G. A. Ledward. "The Use of Auxiliary Current Transformers for Extending the Range of Metering Equipment." Mr. G. F. Shotter.

Wireless Section.—Wednesday, April 6th. Institution, London, W.C.2. 6 p.m. "Electrical Interference with Radio Reception." Mr. A. J. Gill.

Mersey and North Wales (Liverpool) Centre.—Monday, April 4th. The University, Liverpool. 7 p.m. Annual meeting. Short papers.

South Midland Centre.—Monday, April 4th. James Watt Memorial Institute, Birmingham. 7 p.m. Annual general meeting. "Recent Progress in Power Rectifiers and their Applications." Mr. W. G. Thompson.

Tees-side Sub-Centre.—Wednesday, April 6th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "Power Rectifiers." Mr. W. G. Thompson.

Electrical Power Engineers' Association (*Kent Section*).—Saturday, April 2nd. Royal Star Hotel, Maidstone. 6 for 6.30 p.m. Annual dinner and dance.

Association of Supervising Electrical Engineers.—Monday, April 4th. Harris Institute, Technical College, Preston. 7.15 p.m. "Compulsory Wiring Regulations and Registration." Mr. J. Munro.

Institute of the Plastics Industry.—Monday, April 4th. Caxton Hall, Westminster, London, S.W.1. 8 p.m. Annual meeting and smoking concert.

Institution of Heating and Ventilating Engineers.—Wednesday, April 6th. Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. 7 p.m. "Air Purification." Mr. E. L. Joseph.

Institution of Civil Engineers.—Wednesday, April 6th. Great George Street, Westminster, S.W.1. 6 p.m. Informal meeting. "Sub-Surface Investigations by Electrical Methods." Mr. H. M. Gell.

Diesel Engine Users' Association.—Thursday, April 7th. Caxton Hall, Westminster, S.W.1. 4.45 p.m. Discussion on "The Development of the Diesel Engine in all its Aspects during 1937."

Electrical Industries Benevolent Association.—Friday, April 8th. Savoy Hotel, London, W.C.2. 12 noon. Luncheon and annual meeting.

Institution of Engineers-in-Charge.—Friday, April 8th. Holborn Restaurant, London, W.C.2. 6 for 6.30 p.m. Annual dinner.

Physical Society.—Friday, April 8th. Imperial College of Science and Technology, South Kensington, S.W.7. 5.15 p.m. Short papers.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, April 9th. Cardiff. Three short papers on "Underground Illumination in Mines."

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following :—

KEYSTONE electric cleaner.
XENITE moulded battery lids.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. M. Graham, local manager of the Kent Electric Power Co., whose headquarters are at Rochester, has been appointed Kent county manager. Mr. Graham went to Rochester as manager two years ago from the parent company, the County of London Electric Supply Co., Ltd. In his new position he will control the management of nine subsidiary companies of the County of London Co., including the K.E.P., serving an area of 1,200 sq. miles in Kent. **Mr. H. F. Knell,** engineer to the Kent Electric Power Co., becomes area manager. Mr. Knell is a native of Faversham, Kent, and held appointments at Gillingham, Dover, and Sheerness before joining the K.E.P.

Mr. J. G. Park

Mr. J. G. Park, A.M.I.E.E., has resigned his post with the Metropolitan Electric Supply Co., with whom he has been for a year in charge of the Greenford District, following his appointment as assistant mains engineer in the Outside Department of the North Metropolitan Electric Power Supply Co. On completing his technical education at Victoria University, he served for some years on the staff of the Lancashire Electric Power Co., and was later appointed resident engineer with the Electricity Board for Northern Ireland.

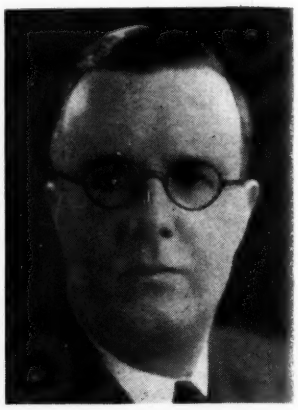
Mr. J. N. Waite, who, as we reported last week, has been appointed to succeed Mr. S. J. Watson as district manager for South East England to the Central Electricity Board, will take up his new duties at the end of June. In referring to Mr. Watson's career in our last issue, we stated that he joined the London and Home Counties J.E.A. in 1937. This should, of course, have read 1927.

Mr. J. Nell, engineer and manager of the Lerwick Electricity Department, has received an appointment with the Grampian Electricity Co. He took over control at Lerwick five years ago on the inception of the town's electricity scheme.

Mr. P. L. Harrop has been elected chairman of the Manchester and District branch of the Association of Supervising Electrical Engineers for 1938-39.

Mr. R. T. Linton, who has been assistant to the consumers' engineer of the Lothians Power Co., Musselburgh, was recently presented with a gold watch by the staff on leaving to take up an appointment at Leeds. Mr. H. C. Babb, general manager and engineer, made the presentation.

Mr. A. J. Moore has been appointed representative of Bylock Electric, Ltd., for the counties of Buckinghamshire, Berkshire, Bedfordshire, Oxfordshire, Hertfordshire, Cambridgeshire, Norfolk, Suffolk and part of Essex, and will also make periodical visits to other parts of the country.



Mr. A. J. Moore

Mr. C. E. Walters, of Salisbury, is shortly leaving to join the central office of the Wessex Electricity Co. at Newbury as deputy commercial and transport manager. He has been in Salisbury eight years as consumers' engineer with the Salisbury Electric Light & Supply Co., Ltd., and before that was with Edmundsons Electricity Corporation, Ltd., at that company's London headquarters.

Mr. S. W. Appleton, of Norwich, assistant engineer at the Bourne office of the Mid-Lincolnshire Electric Supply Co., Ltd., was married recently at Bourne Congregational Church to Miss Peggy Carvath.

Obituary

Mr. C. Cooper.—We regret to learn that Mr. Colin Cooper, a director of Crompton Parkinson, Ltd., died on Monday last at the early age of 45.

Mr. P. R. Friedlaender.—The death occurred on March 25th at Buckhurst Hill of Mr. Percy Reginald Friedlaender, M.I.E.E. Mr. Friedlaender had been a full member of the I.E.E. since 1912, having become an associate in 1901.

Monsieur A. Curchod.—We regret to learn of the recent death in Paris, at the age of fifty-six years, of Monsieur Adrien Curchod, who for the last nine years had held the position of technical editor of *Revue Générale de l'Electricité.*

Monsieur A. Benac.—The death occurred recently in Paris, at the age of seventy-nine, of M. André Benac, one of the founders of the Compagnie Parisienne de Distribution d'Electricité and vice-president of the undertaking since 1921.

Dr. R. T. Moore, a director of the Clyde Valley Electrical Power Co., died suddenly on Tuesday.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

T. A. Stevens & Co., Ltd.—Private company. Registered March 23rd. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in radio and television sets, electric accumulators and batteries, &c. The directors are: T. A. Stevens, 78, Priory Avenue, Chingford, E.4, W. T. Stevens, 10. Brettenham Avenue, Walthamstow, E.17, and F. G. W. Maluish, 10, Norfolk Road, Dalston, E.8. Secretary: F. G. W. Maluish. Registered office: 36, Wilton Way, Dalston, E.8.

James Hacking (Colwyn Bay), Ltd.—Private company. Registered March 24th. Capital, £1,500. Objects: To acquire the business of a radio dealer and engineer carried on by J. Hacking at 74, Abergele Road, Colwyn Bay, as James Hacking. The subscribers are: J. Hacking, The Knoll, Copthorne Road, Upper Colwyn Bay, and G. A. Sedgwick, Tan-y-Coed, Conway Road, Mochdre, Colwyn Bay. J. Hacking shall be permanent governing director and chairman so long as he holds £250 shares.

Stafford & Leslie, Ltd.—Private company. Registered March 24th. Capital, £3,000. Objects: To acquire the business carried on by C. W. and K. W. E. Leslie at Armour House, St. Martin's-le-Grand, E.C.1, and to carry on the business of manufacturers of and dealers in radio and electrical appliances, apparatus and accessories, &c. The directors are: C. W. Leslie, 100, Cleveland Road, W.13, and K. W. Leslie, "Guestwick," The Ridge, Orpington, Kent. Secretary: K. W. E. Leslie. Registered office: Armour House, St. Martin's-le-Grand, E.C.1.

H.L.T. Electric, Ltd.—Private company. Registered March 21st. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in electrical and mechanical appliances, radio apparatus, &c. The directors are: F. Hollyfield and I. S. Laurini, both of 123, Castelnau, Barnes, S.W.13. Registered office: 85, Cromwell Road, S.W.7.

W. F. Bedwell & Co., Ltd.—Private company. Registered March 21st. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in electrical and mechanical apparatus, radio sets, &c. The directors are: W. F. Bedwell and M. Bedwell, both of 434. Durnsford Road, S.W.19. Registered office: 434, Durnsford Road, S.W.19.

Wadden & Hill, Ltd.—Private company. Registered March 21st. Capital, £6,000. Objects: To carry on the business of manufacturers of and dealers in radio and television sets, accessories and apparatus, &c. The directors are: O. V. Wadden, 118, Woodlands Road, Isleworth, and H. J. Hill, 9, Fulwood Gardens, Twickenham.

V. & M. Tucker, Ltd.—Private company. Registered March 19th. Capital, £1,000. Objects: To carry on the business of electrical engineers and contractors, dealers in electrical goods, radio dealers and manufacturers, &c. The life directors are: V. S. Tucker, 21, West Towers, Pinner, and Mrs. M. Tucker, Tudor Royal, Sherwood Avenue, Ruislip. Registered office: 21, West Towers, Pinner.

Electrical Purchase Terms, Ltd.—Private company. Registered March 22nd. Capital, £500. Objects: To carry on the business of capitalists, concessionaires, commercial agents, financial agents and advisers; financiers of hire-purchase agree-

ments, &c. The subscribers are: Wm. A. Gazard, 14, Red House Road, Yardley, Birmingham, and M. Yardley, 49, Heneage Street, Ashted, Birmingham. W. A. Gazard is life governing director. Registered office: 197, Station Road, Stechford, Birmingham.

British & Danubian Manufacturers Corporation, Ltd.—Private company. Registered March 23rd. Nominal capital, £5,000. The objects are to carry on the business of an investment trust company and that of manufacturers of and dealers in electrical, gas, oil and quartz lamps, reflectors, bells, stoves, cookers, switchboards, control gear, insulating materials and electrical and gas plant and accessories, &c. The subscribers are: R. W. Cox, 7b, Cambridge Road, S.W.11, and F. G. Watts, 11a, Kenilworth Road, N.W.6. Solicitors: Forsyte Kerman & Phillips, 44, Brook Street, W.1.

D. M. Bodycombe, Ltd.—Private company. Registered March 23rd. Capital, £1,000. Objects: To acquire the business of an electrical and radio engineer, wholesale and retail dealer, &c., carried on by D. M. Bodycombe at Portland Street, Swansea. The directors are: D. M. Bodycombe and T. G. Bodycombe, both of "Coedmor," Woodlands Terrace, Swansea. Registered office: 2, Portland Street, Swansea.

P. J. Wilson (Leeds), Ltd.—Private company. Registered March 23rd. Capital, £1,000. Objects: To acquire the business of factors and agents for the sale of electrical manufactures formerly carried on by P. J. Wilson and D. A. Skelton as Globe Electrical Supplies at 5, York Place, Leeds. The permanent directors are: P. J. Wilson (chairman), 5, Norton Road, Leeds, and D. A. Skelton, 14, Church Gardens, Moortown, Leeds. Registered office: 5, York Place, Leeds.

Ayliffe Auto-Electric Co., Ltd.—Private company. Registered March 19th. Capital, £200. Objects: To carry on the business of electrical equipment specialists, &c. The directors are: L. H. Ayliffe, 135, Gladstone Avenue, Wood Green, N.21, and V. A. W. Ayliffe, 24, Mead Crescent, South Chingford, E.4. Registered office: 281, Great North Way, Hendon, N.W.4.

General Inductance Co., Ltd.—Private company. Registered March 18th. Capital, £7,000. Objects: To carry on the business of mechanical and general engineers; electrical engineers and contractors, &c. The permanent directors are: W. H. Murad, and N. D. I. Gavin, addresses not stated. Solicitors: Billinghurst Wood & Pope, 7, Bucklersbury, E.C.4.

Specialised Radio Service Co., Ltd.—Private company. Registered March 23rd. Capital, £500. Objects: To acquire the business of radio repairers, dealers and general electrical engineers carried on by H. C. Rylatt and H. J. Gledhill at Tanners Lane, Lincoln. The directors are: H. C. Rylatt and H. J. Gledhill, both of "Chesney," 8, Boultham Park Road, Lincoln, and J. Spencer, Brighty, 61, St. Catharines, Lincoln. Secretary: H. C. Rylatt. Registered office: Tanners Lane, High Street, Lincoln.

Fred H. Jennings & Sons, Ltd.—Private company. Registered March 25th. Capital, £6,000. Objects: To acquire the business of an electrical and mechanical engineer, wholesale and retail distributor of batteries and electrical goods of all kinds, radio goods dealer, etc., carried on by F. H. Jennings at Cinder Bank, Netherton, Dudley, as F. H. Jennings. The directors are: F. H. Jennings, 1, Marriott Road, Netherton, Dudley; and S. Jennings, Oakdene, Church Road, Netherton, Dudley. Solicitor: Wm. Wright, 200, Wolverhampton Street, Dudley.

Gilbert's Electrical, Ltd.—Private company. Registered March 25th. Capital, £1,000. Objects: To acquire the business of Gilbert's Electrical carried on by O. C. Gilbert at 3, Shouldham Street, W.1, and to carry on the business of electrical contractors and radio engineers, &c. The directors are: C. J. Gilbert and O. C. Gilbert, both of 3, Shouldham Street, W.1. Registered office: 3, Shouldham Street, W.1.

J. Errington (Engineers), Ltd.—Private company. Registered March 26th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, insulators, stoves, cookers, electrical plant, &c. The directors are: J. Errington and Mrs. M. L. Errington, both of Coniscliffe, Kenton, Newcastle-on-Tyne. Secretary: J. Errington. Registered office: 15, New Bridge Street, Newcastle-on-Tyne, 1.

Woodford Electrical Co., Ltd.—Private company. Registered March 18th. Capital, £300. Objects: To acquire the business of an electrical engineer and contractor carried on by R. F. Liddle at 238, Woolwich Road, Charlton, S.E.7. The first directors are: R. F. Liddle, 238, Woolwich Road, Charlton, S.E.7, and F. W. Hayward, The Shanty, London Road, Hickstead, Sussex. Registered office: 6a, Station Parade, Burgess Hill, Sussex.

Returns of Electrical Companies

Adelaide Electric Supply Co., Ltd.—Capital, £3,375,000 in £2,000,000 preference stock, £750,000 preferred ordinary stock and £625,000 ordinary stock. Return dated December 2nd, 1937. All stock taken up. £3,120,000 paid on £2,000,000 preference stock, £750,000 preferred ordinary stock and £370,000 ordinary stock. £255,000 considered as paid on £255,000 ordinary stock. Mortgages and charges at date of return: £1,577,274. On March 1st, 1938, £928,962 was paid off and £858,236 new debenture stock was created.

Carlux Electrical Services, Ltd.—Mortgage dated October 23rd, 1925, charged on 17, Nicholas Street, Chester, with yard, outbuildings and garage (being property acquired by the company on March 1st, 1938). Amount owing: £1,000. Registered pursuant to Section 81 of the Companies Act, 1929. Mortgagee: H. R. Granger, Littleton Hall, near Chester.

British Electric Domestic Appliances, Ltd.—L. V. Smith, chartered accountant, of 25, Oxford Street, W., was appointed receiver and manager on March 12th, 1938, under powers contained in debenture dated February 23rd, 1938.

Swedish General Electric, Ltd.—Capital, £100 in £1 shares. Return dated January 5th, 1938. Two shares taken up. £2 paid. Mortgages and charges nil.

Long & Carter, Ltd.—Capital, £1,300 in £1 shares. Return dated November 9th, 1937. All shares taken up. £800 paid, £500 considered as paid. Mortgages and charges nil.

H. H. Hartfree, Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1. Return dated December 31st, 1937. 1,000 preference and 845 ordinary shares taken up. £100 paid, £100 calls unpaid, £1,645 considered as paid. Mortgages and charges nil.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.—Capital, £1,250,000 in 250,000 preference, 150,000 preferred ordinary, 100,000 ordinary and 750,000 unclassified shares of £1 each. Return dated December 28th, 1937. All the preference, preferred ordinary and ordinary shares taken up. £500,000 paid. Mortgages and charges: £381,100.

Wholesale Electric Supplies (Bolton), Ltd.—Capital, £100 in 1,000 shares of 2s. Return dated December 29th, 1937. All shares taken up. £100 paid. Mortgages and charges nil.

Kye Electrical, Ltd.—Capital, £25,000 in 20,000 preference shares of £1 and 100,000 ordinary shares of 1s. Return dated September 3rd, 1937. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges nil.

Wrexham Motor & Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 8th, 1937. 1,428 shares taken up. £1,428 paid. Mortgages and charges nil.

Ellesmere Port Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated October 28th, 1937. 450 shares taken up. £251 paid. £199 considered as paid. Mortgages and charges, nil.

Ralph Garrett, Ltd.—Capital, £1,000 in 1,000 ordinary shares of £1. Return dated October 13th, 1937. 802 shares taken up. £802 paid. Mortgages and charges, £1,500.

E. S. S. Signs, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 1st, 1938, to secure £4,000 (ranking *pari passu* with existing debenture for £5,000). Holders: Branch Nominees, Ltd.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 and 35,000 ordinary shares of 4s. Return dated December 24th, 1937. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Mid-Cumberland Electricity Co., Ltd.—The nominal capital has been increased by the addition of £50,000 in £1 ordinary shares beyond the registered capital of £300,000. Practically the whole of the issued shares are held by the Electrical Distribution of Yorkshire, Ltd.

Community Radio (1928), Ltd.—Capital, £30,000 in £1 shares. Return dated December 13th, 1937. 18,288 shares taken up. £18,188 paid. £100 considered as paid. Mortgages and charges, £1,500.

Radio & Accessories (1933), Ltd.—H. G. Yates, of 86, Cannon Street, E.C., was appointed receiver and manager on March 17th, 1938, under powers contained in debenture dated October 20th, 1934.

F. & D. Robinson (Warlingham), Ltd.—G. A. Smith, of 110, Cannon Street, E.C.4, ceased to act as receiver and/or manager on March 16th, 1938.

Express Magneto (Repairs) and Electrical Co., Ltd.—Capital, £2,000 in 1,500 preference and 500 ordinary shares of £1. Return dated December 23rd, 1937. All shares taken up. £2,000 paid. Mortgages and charges, £3,000.

M. P. A. Wireless (1930), Ltd.—Capital, £10,000 in 200,000 ordinary shares of 1s. Return dated January 13th, 1938. 81,227 shares taken up. £61 7s. paid on 1,227 ordinary shares. £4,000 considered as paid on 80,000 ordinary shares. Mortgages and charges, £21,295.

City Notes

The North-Eastern Electric Supply Co., Ltd., held its annual meeting on March 23rd when Mr. R. P. Sloan (chairman), who presided, said that new connections during the year amounted to 116,379 h.p., which brought the total at the end of last year up to 1,228,541 h.p. During the year they secured 19,230 additional consumers of all classes, and a large proportion of the number of new domestic consumers was obtained in the rural areas. With reference to the Newcastle Corporation's option to purchase a part of their distribution undertaking within the city which was exercisable by them during the latter part of 1937, as a result of an agreement made between the Corporation and the company this option had been postponed and would not be exercisable before the expiration of the next two or three years. They were concerned with the new legislation affecting the coal industry, and hoped that they, along with other public utility undertakings, would not be called upon to bear an undue burden in the increased cost of coal. In spite of the increases which had already taken place in the cost of coal and the uncertainty regarding the future, they had decided to make further reductions in some of their standard lighting and domestic tariffs as from the beginning of April. These would have the effect of unifying the tariffs within each of the three respective tariff areas into which their territory would then be divided. While they were glad to make these reductions they were anxious that their future policy in this direction might not have to be modified due to any abnormal increases in the cost of coal which might be the outcome of any legislation. With regard to the change of frequency programme, apart from carrying out the work in connection with one or two comparatively small matters, this extensive enterprise had now been completed, and the whole of their system was operating at a frequency of 50 cycles. The general progress which had been made had been assisted by further improvement in the shipbuilding and engineering trades. Their supplies to collieries also showed further increases, and they, as well as many colliery owners, were receiving some reward for the extensive electrification schemes which were undertaken during the period when the coal trade was less active than it was to-day. So far as the iron and steel trades were concerned they succeeded last year in secur-

ing considerable additional business, particularly as a result of the installation of large rolling mills in the Middlesbrough and West Hartlepool areas, and they could look forward to a continuance of great activity in this sphere of operations. They had arranged to supply the electricity required for the L.N.E.R. Co.'s electrification scheme for the line between Newcastle and South Shields. New factories were continuing to be opened on the Team Valley Trading Estate, where they had now provided facilities to meet all the electrical requirements. At the end of last year they had on hand applications for new connections amounting to 45,276 h.p., which represented a greater "order book"—to the extent of 13,549 h.p.—than at the corresponding period of the previous year. They had in hand at the present time an extension to the Dunston "B" power station. In the last published returns issued by the Electricity Commissioners this station stood second in the list of those in this country producing more than 200 million kWh per annum as regards both coal consumption and thermal efficiency.

The Lancashire Dynamo & Crypto, Ltd., held its annual meeting on March 28th, when Mr. A. E. L. Chorlton (chairman) said that the profit of £133,270 for the past year was a record in the history of the company. These profits were not due to inflated prices, but to a greatly increased output. With regard to their associated companies, the purchase of the shares of the Foster Engineering Co. was completed in May last, and their balance sheet, made up to December 31st covering the eight months' period, showed a satisfactory profit and represented a substantial increase on the rate of profit earned in the previous year. Their business was expanding in various directions. The Crypton Equipment Co. had made good progress, and the directors of that company anticipated a successful year in 1938. Dynamo & Motor Repairs, Ltd., and Ferrous Light Castings, Ltd., in each of which they held a considerable interest, had both had record years in 1937. Bepco, Ltd., had benefited from the recovery in trade in Canada. It had secured important orders for the L.D.C. Co. in Canada, and, in addition, had earned a reasonable profit, sufficient to cover with some margin the losses made in the first year of its operation. The experiment which this selling company (jointly owned by four competing companies in this country) represented had been a complete success, and the agreements between the companies owning Bepco, Ltd., were being renewed for a further ten years. Their own works, both at Manchester and Willesden, had operated throughout the year at high pressure, and their production had far exceeded in value and tonnage any previous figures. Their food machinery section at Willesden had benefited from the extensions completed during the year, which were now devoted entirely to the products required by this section. The business was growing steadily and operated with a satisfactory profit. They continued to obtain important business from overseas, and during 1937 approximately 30 per cent. of their works output had been exported, mainly to territories within the British Empire. They had commenced 1938 with the largest volume of orders on their books that had ever been experienced, and, with a tendency now existing for costs to fall a little, they should look forward with reasonable confidence to the future.

The Clyde Valley Electrical Power Co.—The opinion that the Electricity (supply) Act, 1926, operated unfairly in regard to selected station owners and that it should be amended was expressed by Mr. Charles Ker, chairman, at the company's annual general meeting held on Tuesday. The Act, he said, had brought no benefit either to the company or its customers. With regard to the delay in seeking additional capital it must be explained that since the matter was first discussed with the Electricity Commissioners there had been a material change in the outlook of the industry. Although they did not know what the Electricity Bill might contain, it was only too clear that the franchise enjoyed by the company would be limited. Nevertheless, the company's vigorous and growing business required steady expansion and accordingly an extraordinary general meeting would be called for April 13th to authorise the creation of 2,100,000 shares of £1 each to be issued as the directors thought fit. The Empire Exhibition which was to be opened in May should help Empire trade and would, they hoped, benefit industry in Scotland, particularly in their own area. It was hoped, too, that the industrial estate at Hillington, promoted by the Commissioners for Special Areas in Scotland, would attract lighter industries hitherto deficient. The distribution system had been further extended and improved, and considerable duplication and reinforcement of main feeder cables had been carried out, particularly in connection with the Kirkintilloch ring and with the developing loads along the Clyde between Scotstoun and Dumbarton. New main cables had been laid to meet additional loads in the Cambuslang-Rutherglen section. Sales of electricity amounted to 431 million kWh, 54 million kWh more than in the previous year, and 34,008 h.p. had been added to connections, bringing the total to 489,829 h.p. The number of new consumers was 16,583, bringing the total to 145,939. Assisted wiring schemes had contributed largely to the remarkable growth in the number of domestic consumers; 40,945 had had their installations provided under this method.

The British Aluminium Co., Ltd., held its annual meeting on March 29th, when Mr. R. W. Cooper (chairman,) who presided, said that 1937 commenced with a satisfactory order book and the demand for their products was well maintained throughout the year, resulting in their marketing the largest tonnage of aluminium in their history. The first half of the additional aluminium producing plant at Lochaber was put into commission early in March this year. The enlargement of the alumina works right up to the boundary of their property at Burntisland was nearing completion, and as the extra amount of alumina thus provided would be insufficient for their requirements they had acquired land at Newport (Mon.), where an immediate start had been made with the preparation of the site and the erection and equipment of a factory. This factory would, they hoped, reach the production stage later this year. The demands for aluminium alloys were increasing and uses were being found in new fields. The construction of domestic refrigerators was a growing business, which took large quantities of aluminium, and radio sets and washing machines also accounted for a considerable consumption of their metal.

The Bournemouth and Poole Electricity Supply Co., Ltd.—Summarising some of the more important features of the year's work at the annual general meeting on Tuesday, Sir Bernard E. Greenwell, chairman, stated that sales of electricity had increased by 11½ million kWh, or nearly 25 per cent., during the year, and once again had more than doubled during the past five years. Receipts from the sale of electricity and meter rentals, totalling £466,916, showed an increase of nearly £41,000 over 1936, but only one item of expenditure, purchase of electricity, had increased by some £24,700, due partly to the increase in the cost of coal. Considerable reductions in charges had been made in the areas of subsidiary companies with a view to achieving uniform zoning. During the year thirteen new points of supply had been opened up, the mains system having been extended by 24 miles of high-voltage mains and 105 miles of low-voltage mains. Supplies were now available in practically the whole of the company's rural area. Further progress had been made with street lighting and a contract had been secured for illuminating eight miles of main roads at Poole for ten years. In Bournemouth a further three miles of main roads had been changed over to electricity and an order had been placed for converting ten miles of secondary traffic routes. The subsidiary companies continued to make substantial progress, and, taken as a whole, had increased their sales by 46 per cent. over the previous year and had added 15 per cent. more consumers.

The Richmond (Surrey) Electric Light and Power Co., Ltd.—Presiding at the annual meeting on March 29th Sir Robert Renwick, Bt. (chairman), said that although the kWh sold during the year increased by 15 per cent. over the previous year and the revenue by 9 per cent., the amount available for distribution to shareholders was only £400 greater than for 1936; in other words, the benefit of their development during the year had been passed on to their consumers. During the year they reduced the flat rate for lighting to 4¾d. per kWh, and had also introduced a new scheme to help consumers of the artisan class. They could now obtain, on favourable hire-purchase terms, a cooker, two saucepans and a kettle, an iron and wiring for five lighting points for a small weekly payment, and there were a number of consumers under this scheme to whom the cost worked out at 1¼d. per kWh, including the hire-purchase terms for all the apparatus mentioned. At present there was a saturation of nearly 44 per cent. of cookers among the domestic two-part tariff class of consumer. These facts demonstrated that they were capable of high operating efficiency and could not be regarded as one of those undertakings from which benefits would flow from any absorption by neighbouring concerns.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. reports a net profit for 1937 of £543,682, as compared with £544,367 in the previous year. A sum of £240,000 is placed to reserve, and it is proposed to pay a final dividend of 4 per cent. on the "A" ordinary capital, making 8 per cent. for the year (same), and a final dividend of 3 per cent. on the "B" ordinary, making 5½ per cent. (against 6½ per cent.). The balance carried forward is £65,343 (against £55,411 brought in). The report states that although the quantity of kWh sold has improved by 16.5 per cent. as compared with 1936, the average price received per kWh has shown a reduction of 7 per cent., while costs of coal, materials and wages have substantially increased. Meeting: April 12th.

The Marconi International Marine Communication Co., Ltd., reports a net profit for 1937 of £114,844, a decline of £2,000, which was more than accounted for by the absence of profit on sale of securities, which amounted to £8,632 in 1936. Reserve for depreciation receives £20,000 and N.D.C. £6,000. The final dividend is 5 per cent., making 7½ per cent. for the year, and £11,698 is carried forward (against £12,308 brought in).

Electrical Switchgear and Associated Manufacturers, Ltd., has declared an interim dividend of 6 per cent. (actual), less tax, on the ordinary shares. This is the same as last year, but is paid on increased capital.

The Anglo-Portuguese Telephone Co., Ltd., is paying a final dividend of 5 per cent. on the ordinary stock, making 8 per cent. for 1937 (unchanged). A dividend of 8 per cent. is also recommended on the "A" ordinary shares (same).

The Telephone & General Trust, Ltd.—Presiding at the annual meeting held on March 24th Sir Alexander Roger (chairman) said that an examination of the geographical distribution of their investments showed that the proportion invested in Great Britain now amounted to 66 per cent. The recovery in Venezuela which commenced in 1936 continued steadily throughout 1937. Station growth continued on a satisfactory basis, and there was now a waiting list for the first time for some years. Telephone Properties, in which they were directly interested, was the parent of the Nacional Co., and arrangements had been made during the past few months for an increased participation of investors in the Nacional Co. in Venezuela, accompanied by a corresponding reduction of the amount held by British investors in Telephone Properties. The Jamaica Co. continued to expand, and the company in Trinidad, which supplied the telephone service to Port of Spain and the rest of the island, continued to make progress. The committee appointed to make recommendations to the Government regarding the grant of a new franchise had now recommenced its deliberations and negotiations were now actively in progress. The company was making an endeavour to deal with existing urgent needs by sanctioning expenditure upon works involving £56,000. The installation of modern automatic equipment in Barbados was completed and put into service towards the close of 1937. The telephone company in Portugal continued to make satisfactory progress. The station growth during 1937 proceeded at the rate of 6.8 per cent. and capital expenditure amounting to £268,000 was undertaken. An extension of the supply contract with the Polish Minister of Posts, Telegraphs and Telephones had been arranged in

association with the Automatic Telephone and Electric Co. on a satisfactory cash basis. Provided no major political upheaval occurred the results for the current year should be at least as good as those for the year just ended.

Enfield Cable Works, Ltd., held its annual meeting on March 23rd when the Earl of Verulam (chairman and managing director), who presided, said that they had enjoyed the second best year in their history. The sales for the year were a record. In money value the figure of turnover was inflated by the high cost of materials in the first half of 1937, because contracts taken during that time were completed before the end of the year; but even so, the output of the works measured in miles of cable was also the largest that they had so far achieved. The chairman then explained in detail the proposals of the directors with reference to the capitalisation of £300,000 of reserves, the distribution of this new capital as bonus to the ordinary shareholders and the conversion of shares into stock. With regard to the general prospects, they started 1938 with a substantial number of orders in hand, and had been fairly successful in obtaining orders in the first two and a half months. There appeared to be a slight falling off in the volume of new orders, but they anticipated that they would get their share of whatever was going. Despite the adverse effect on buying power that taxation was likely to have, and despite the general dislocation that disturbances abroad must have on export business, he was anticipating a satisfactory year. The report and accounts were adopted and the resolutions in connection with the directors' capital proposals were passed.

The South Wales Electric Power Co.—Presiding at the annual meeting on March 22nd Mr. W. N. Lewis (chairman) said that there had been a distinct improvement in the industrial operations in their district and their well-planned generation and transmission system had been the means of procuring a fair share of the additional supplies which had been required. During 1937 the consumers connected increased by 18 per cent. over 1936, and the kWh sold had shown an increase of 17 per cent. One local authority, the Caerphilly U.D.C. had exercised its right to acquire from them the distribution undertaking in its district with effect from January 1st, 1938, and they themselves had acquired the undertaking of the Brynamman and District Electric Supply Co., Ltd., this with effect from January 1st, 1937. In compliance with a direction from the Central Electricity Board they were at the present time engaged upon an extension of the generating plant at Upper Boat. When completed the station would be capable of fulfilling any demand which might be made upon it from the growing business in South Wales.

The South London Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on March 23rd. Lord Gainford (chairman), said that the kWh sold to consumers showed an increase of 14.5 per cent. as compared with the previous year. There was a net capital expenditure during the year of £107,026, the principal items of which were in respect of mains and meters. The increase in expenditure under the heading of special items was attributable to the cost incurred in connection with the important contract for public street lighting received from the Lambeth Borough Council. As mentioned last year, they put into force a reduction in the flat rate for lighting from the beginning of the year, so that they had now achieved uniformity in rates for supply together with their associated companies, the County of London Electric Supply Co. and the South Metropolitan Electric Light & Power Co.

Associated Electrical Industries, Ltd., reports a profit for 1937 of £1,290,008, as compared with £1,055,624 for the preceding year. From this is deducted depreciation (£217,756), and income tax and N.D.C. (£380,759), and after adding £176,118 brought in there is a balance available of £867,611. Of this £100,000 is placed to special reserve, and £100,000 to dividend equalisation account. The ordinary dividend for the year is maintained at 10 per cent., less tax, and £220,015 is carried forward. The report states that the output from the various works of the group was greater than in previous years. Orders received during 1937 as well as orders in hand at December 31st showed a substantial increase over those for 1936 and constituted a record. Meeting: April 1st.

McMichael, Ltd.—Presiding at the annual meeting on March 28th. Mr. H. L. McMichael (chairman) said that although their turnover was increasing up to the early autumn the profit was lower than for the previous year due to the slump which set in at the end of the year, felt not only by themselves but by the radio trade in general. While the results during the latter months were not so good as they had hoped, they were able to limit production and finish the year without large stocks in hand. So far this year they had already launched one new model and others were well forward. During the year the research department had kept abreast of the developments in television, and certain monies had been expended on working details.

The Automatic Telephone & Electric Co., Ltd., reports a profit for 1937, after charging directors' fees, depreciation and amount written off patent rights and goodwill, of £148,624, as compared with £133,564 for the previous year, to which is added £85,446 brought in, making £234,070. General reserve receives £10,000, and it is proposed to pay a final dividend of 7 per cent. on the ordinary stock, making 10 per cent. for the year (same), 10 per cent. on the deferred stock, and to carry forward £105,632.

The Southern Areas Electric Corporation, Ltd., reports profits for 1937 of £37,953, after provision by subsidiaries of £20,952 for depreciation. This compares with £26,502 for 1936, after setting aside £18,514 for depreciation. The final dividend is 3 per cent., making 5 per cent. for the year (against 4½ per cent.), and £16,030 is carried forward (against £7,458 brought in).

The West Kent Electric Power Co., Ltd., reports a net revenue for 1937 of £113,758, as compared with £98,024 for 1936. Depreciation, renewals, &c., receive £40,000, tax reserve £5,000, and general reserve £25,000. The final ordinary dividend is 5 per cent., making 8 per cent. for the year, and £20,384 is carried forward. The sales of electricity amounted to 99,236,000 kWh, an increase of 17,842,000 kWh.

Newman Industries, Ltd., reports a profit for 1937 of £31,441 as compared with £26,297 for 1936, to which is added £2,246 brought in. The ordinary dividend for the year is 25 per cent. (against 17 per cent. per annum for the period April 3rd to December 31st, 1936). Income tax reserve receives £5,500, general reserve £10,000, and £3,337 is carried forward.

The North British Aluminium Co. reports a trading profit for 1937, including income from subsidiary company, of £181,152. Loan interest absorbs £99,747, income tax £13,193, and depreciation £7,500, leaving £60,712. A sum of £30,000 is placed to reserve, leaving a balance of £30,712. To this is added £21,849 brought in, making £52,561 to be carried forward.

The Windermere & District Electricity Supply Co., Ltd., reports a profit for 1937 of £13,271, to which is added £5,616 brought in. It is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year, and to carry forward £5,396.

The Urban Electric Supply Co., Ltd., reports a profit for 1937 of £130,863, as compared with £105,448 in the previous year. To this is added £48,410 brought in, making £179,274. The final ordinary dividend is 5 per cent., making 8 per cent. for the year (same), and £52,274 is carried forward.

Brown Bros., Ltd.—In the report of the annual meeting in our last issue we stated that the chairman was Mr. J. A. Morrison. This should have read Mr. J. A. Thomson, who is chairman and managing director of the company.

The Telegraph Condenser Co., Ltd., is paying a dividend of 5 per cent. for 1937 (against 10 per cent.).

The Société Financière de Transport et d'Entreprises Industrielles (Sofina) reports a revenue for 1937 of 124,176,312 Belgian fr. (£841,873) as compared with 115,803,141 fr. (£785,105) in 1936, and a net profit, including amount brought in, of 113,402,356 fr. (£768,829), as against 104,450,466 fr. (£707,596). After paying a dividend of 440 fr. (same) and providing for tax reserve, a balance of 11,252,356 fr. (£76,280) is carried forward.

The Melton Mowbray Electric Light Co., Ltd., reports a net profit for 1937 of £4,733 (against £6,061 for 1936). The final dividend is 6 per cent., making 10 per cent. for the year (same), and £1,328 is carried forward.

Brilliant Signs, Ltd., reports a net profit for 1937 of £17,109. It is proposed to pay a final ordinary dividend of 6 per cent., making 10 per cent. for 10½ months, and to carry forward £2,203.

The Montreal Light, Heat and Power Consolidated has announced an interim dividend of 37 cents on the common shares for the quarter to March 31st (same).

The Hankow Light & Power Co., Ltd., is again paying 8 per cent., less tax, on the ordinary shares for the year ended March 31st.

Heatrae, Ltd., has declared a dividend of 12 per cent., less tax, for the year, as against 10 per cent. actual for the period to February 28th, 1937.

A. Reyrolle & Co., Ltd., are paying a final dividend of 7½ per cent., maintaining the dividend for the year at 12½ per cent., less tax.

Stocks and Shares

Tuesday Evening.

Stock Exchange markets suffer from the disquieting influences of an American slump, caused mainly by the policy which President Roosevelt persists in pursuing. Whether it be right or wrong, this policy exerts a malevolent effect over Americans, which have fallen very heavily during the past few weeks, and, also, upon many other stocks and shares whose prices have dropped in sympathy. There may be no very obvious connection between Washington's New Deal and, say, South African mining shares, but in point of fact one set of conditions will affect them both, and not them alone, but a dozen other markets besides.

At home, there is the approach of the Budget on April 26th, to enforce caution upon investment. What with one thing and another, Stock Exchange business and market prices have shrunk to a degree which, this time last year, might have seemed an impossibility. The fortunate people are those who either have no money at all, and therefore have nothing to lose, or others who, foreseeing the present state of affairs, sold all that they had and put the money on deposit.

Gilt-edged Securities

The moderately steady condition of gilt-edged prices speaks well for the confidence with which the Consol market awaits the opening of the Budget. Quotations are sustained above the levels to which they fell on the first realisation that the Government must now become an even larger borrower on account of the defence programme. Nobody underrates, of course, the burden which is in prospect for the shoulders of the gilt-edged market. But opinion has become reassured that an increase in direct taxation will be avoided as far as is possible; consequently, there is no serious apprehension concerning a further reduction in the net yields on fixed-interest stocks. At the same time, it is felt that the natural pressure of unemployed funds, in conjunction with the Treasury's anxiety to keep money cheap, will help to buttress prices against the new Government loans which are evidently coming to the market. The main concern, from the ordinary investor's point of view, is still the possibility that the cost of living will be forced up to some extent, with unfavourable consequences for the actual value of fixed incomes. On the week, the price of War Loan is 10s. lower at 101¾, which is 2 points better than the recent low point. Prices of Central Electricity Board issues and other public board stocks are about the same as they were a week ago.

Electricity Supply

Taking their tempo, as usual, more from the gilt-edged than the industrial markets, electricity supply shares have a tolerably firm appearance, with a tendency here and there towards modest improvement in prices. County of London, for instance, rose by 1s. 6d. to 48s. 6d. after the meeting, and Metropolitans have gained the same amount to 47s. Among the northern companies, Yorkshire Electric at 38s. and Clyde Valley at 39s. are better. Southern Areas moved up to 20s. 3d. on the raising of the dividend from 4¼ per cent. to 5 per cent. The price is still cum-dividend.

Industrials

Industrial markets have had a fairly satisfactory week. The markets' behaviour under difficult circumstances is, by general consent, a heartening sign. Optimism is looking for an all-round stimulus to trade and, consequently, to markets, as a result of bigger defence expenditure by the Government. Against this has to be set the possibility of some dislocation in certain trades as a result of priority being given to armament work; and the unknown quantity of what the Budget has in store for industrial profits. Until something definite is known on the latter question, most people expect markets to march as evenly as they are allowed to by political developments. Later on activity may justifiably be expected to develop in a wide range of industrial shares. Iron and steel issues are inclined to resist the prevailing dull conditions. Babcock & Wilcox have gained the pence at 40s. 9d. Rubber shares continue stagnant and depressed.

Electrical Equipment and Manufacturing

A recovery to 23s. 9d. in the price of Crompton Parkinsons was an early feature among the week's price-movements in electrical equipment shares, but the quotation slipped back later to 22s. 6d. In the worst of this month's troubles the price was, at one time, no better than 18s. 9d. The British Insulated Cables report has been receiving a more proper share of attention, and the shares have risen to 4½, or 7s. 6d. above the recent worst. Henleys have recovered from 16s. 3d. to 17s. 6d. Enfield Cables, at 2⅝, are now quoted ex bonus. There is little change in other cable manufacturing shares, holders of which are paying some attention to the announcements of an early start on operations at the Scottish and Aberdare companies' cable works. Associated Electrical Industries shares eased off to 36s. after publication of the accounts, although the expansion in profits gave a measure of compensation to hopes which had been disappointed by the absence of an increase in the dividend. General Electrics, which have lately been down to 67s., climbed back to close on 70s. Automatic Telephone ordinary have eased to 37s., at which the yield on the newly declared 10 per cent. dividend is £5 8s. per cent. Allen Wests, which are back in the dividend list with a payment of 7½ per cent., are steady at 5s. 9d. Reyrolles, at 51s., yield about 5 per cent. on the maintained dividend of 12½ per cent. Telegraph Condensers sank from 17s. 6d. to 12s. 6d. on the halving of the dividend, to 5 per cent. Satisfaction with the British Aluminium report is reflected in a rise of 1s. 9d. to 47s. 6d. in the price of the shares.

Cable and Wireless

Despite a small recovery, the price of Cable and Wireless ordinary stock is still under 60. At the time when hopes first began to rise on the expectation of an early agreement between the Combine and the Empire Governments, the stock was changing hands up to 69. The assumption now is that negotiations are giving place, for the time being, to more urgent business, and that, in consequence, hope may have to be temporarily deferred. This leaves more time for contemplation of the table of monthly traffic indices, which do not make a pleasing prospect, current figures being substantially below those ruling a year ago. Also the pace of international trade is not moving in favour of the Cable and Wireless traffics. The annual report is due next month, and the market is awaiting confirmation of the official forecast of a 4 per cent. dividend on the reorganised ordinary capital. A dividend at that rate would bring the yield on Cable and Wireless ordinary to over 6½ per cent. at the present price.

Foreign Affairs

American stock-prices reflect another drop in the hopes of an early revival of business. Following Mr. Roosevelt's latest, and one of his bitterest, tirades against the business barons, and in the absence of the normal signs of spring activity. Wall Street spirits—and stock-prices with them—have fallen into deeper despondency. The drop of 12 points, to 117½, in American "Tel. and Tel." gives an idea of the severity of the latest break in prices. South American stocks are also under a cloud, partly owing to less favourable trading repors from Argentina, Brazil and elsewhere. Anglo-Argentine Tramway 5 per cent. debentures are no better than 12; the four per cents. have fallen this week from 26 to 23, and the four-and-a-halves from 21 to 20. Brazilian Tractions are flat at 8½. Stocks connected in any way with Mexico are inevitably unsettled by the local Government's decision to expropriate the Mexican oilfields. Mexican Light common stock is virtually unsaleable, and the 5 per cent. first mortgage bonds have been marked down from 30 to 25. Altogether the foreign scene is anything but cheerful from the investor's point of view. Troubled though it may be, the prospect at home is decidedly more pleasant.

Share List of Electrical Companies

	Dividend. Nom.	Previous.	Last.	Price Mar. 29.	Rise or Fall.	Yield. p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	63/9	—	4 14 4
City of London	1	7½	7½	33/6	—	4 9 7
Clyde Valley	1	7	8	39/-	+1/-	4 2 3
County of London	1	10½	10½	48/6	+1/6	4 6 7
Edmundson's 7% Pref.	1	7	7	32/-	—	4 6 2
Do. Ord.	1	8	9	36/-	—	5 0 0
Elec. Dis. Yorkshire	1	9	9	39/-	—	4 12 4
Elec. Fin. and Securities	1	12½	12½	48/9	—	5 2 6
Elec. Supply Corporation	1	11	12	51/3	—	4 13 8
Lancs Light and Power	1	7½	7½	32/6	—	4 12 4
Lond. Assoc. Electric	1	—	7	30/-	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	104½	—	4 15 8
Metropolitan	1	10	12	47/-	+1/6	5 2 2
Midland Counties	1	7½	8	35/6	—	4 10 0
Mid. Elec. Power	1	8	9	38/9	—	4 13 0
North Eastern Electric Ordinary	1	6	7	28/6	—	4 18 4
Do. 7% Pref.	1	7	7	32/6	—	4 6 2
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	46/3	—	4 6 6
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	35/-	—	4 11 5
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	+⅛	8 0 0
Yorkshire Elec.	1	8	8	38/-	+6d.	4 4 4
Public Boards.						
Central Electricity, 1950–70	Stock	5	5	110½	—	4 10 6
Do. 1955–75	„	5	5	114½	—	4 7 2
Do. 1951–73	„	4½	4½	108½	—	4 3 0
Do. 1963–93	„	—	3½	98½	—	3 11 0
London Elec. Trans. Gtd.	„	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A	„	—	4½	117½	—	3 16 6
Do. do. B	„	—	5	120⅜	—	4 3 0
Do. do. C	„	4	4⅝	79½	—	5 7 0
West Midlands Joint Elec. 1948–68	„	—	5	111	—	4 10 1
Telegraph and Telephone.						
American Tel. & Tel.	$160	9	9	117½	−12	7 13 3
Anglo-Am. Tel. Pref.	Stock	6	6	107½	—	5 11 7
Do. Def.	„	1½	1½	26½	—	5 13 2
Cable & Wireless 5½% Pref.	„	4½	5½	98½	—	5 11 8
Do. Ord.	„	—	—	59½	—	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	13½	—	4 3 0
Do. do. Pref.	10	6	6	13	—	4 12 4
Great Northern Tel.	10	20	20	38½	−½	5 4 0
Marconi-Marine	1	10	7½	27/6	—	5 9 1
Oriental Telephone Ord.	1	12*	12*	2⅛	—	4 9 3
Home and Foreign Trams, etc.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/-	+1/3	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	12	—	—
British Electric Traction Def. Ord.	„	5	5	875	−25	—
Do. do. Pref. Ord.	„	8	8	155	—	5 3 3
Brazil Traction	$100	70 cts.	$1	8½	−¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	—	5 0 6
Mexican Light Common	$100	Nil	Nil	1	−¼	—
Do. 1st Bonds	$500	5	5	25	−5	—
Victoria Falls Ord.	1	20	12	57/6	+⅛	4 3 5
West Riding	1	6½	10	37/6	—	5 6 8
Manufacturing Companies.						
Aron Electricity Ord.	1	15	15	1⅞	—	8 0 0
Assoc. Elec. Ord.	1	10	10	36/-	−6d.	5 11 3
Do. Pref.	1	8	8	38/-	—	4 4 6
Babcock & Wilcox	1	8	10	40/9	+9d.	4 18 0
British Aluminium Ord.	1	10	12½	47/6	+1/9	5 5 2
British Insulated Ord.	Stock	20	20	4½	+½	4 14 1
Brush Ord.	Stock	Nil	Nil	16½	−1	—
Callender's	1	15	15	4½	—	3 12 9
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	22/6	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	32/6	—	6 3 1
Enfield Cable Ord.	1	25	25	2⅝xb.	—	—
English Electric	1	Nil	10	27/6	—	7 5 6
Do. do. Pref.	1	6½	6½	25/-	—	5 4 0
Ericsson Tel.	5/-	25	25*	1⅛	—	3 14 1
Ever Ready	5/-	35	45	24/6	—	9 3 8
Ferranti Pref.	1	7	7	25/-	—	5 12 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	69/6	+6d.	5 0 9
Henley's	5/-	30	15	17/6	+⅛	4 5 9
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	½	10	36/3	—	5 11 1
Lancashire Dynamo	1	20	25	2⅞	—	8 14 0
Siemens Ord.	1	6	7½	26/3	—	5 14 1
Telegraph Construction	£1	7½	10	37/6	—	5 6 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

15010. "Devices utilising secondary electron emission." British Thomson-Houston Co., Ltd., and D. Gabor. May 27th, 1936. (480786.)

15095. "Scanning devices for television and like systems." Soc. Anon. Franco-Belge d'Electricite and J. Loeb. May 28th, 1936. (480859.)

15457. "Electrolytic deposition of chromium." W. P. Williams (Rojas Chemical Works, Inc.). June 2nd, 1936. (480,945.)

15673. "Cathode-ray devices." British Thomson-Houston Co., Ltd., and D. Gabor. June 4th, 1936. (481094.)

17630. "Cathode-ray tubes employing photo-electric mosaic screens." L. Klatzow. June 25th, 1936. (480946.)

17804. "Electron-optical arrangement." Radioakt.-Ges. D. S. Loewe. June 27th, 1935. (480779.)

17896. "Electro-magnetically operated contactors, circuit-breakers, and the like switchgear." F. B. Cox. July 27th, 1937. (481095.)

20564. "Synchronised electric drives for printing-presses and like machines." British Thomson-Houston Co., Ltd., and L. J. Clark. July 24th, 1936. (480783.)

20573. "Electric cables." Norddeutsche Kabelwerke Akt.-Ges. March 24th, 1936. Addition to 20329/36, 20330/36, 20331/36, 20332/36 and 20333/36. (480784.)

20604. "Cathode-ray tubes." F. H. Nicoll. July 25th, 1936. (480948.)

21046. "Electron lenses." W. D. Wright and O. Klemperer. July 30th, 1936. (Cognate application 13036/37.) (480857.)

23784. "Electric vibrators." G. M. O. Jenkins. August 31st, 1936 (481107.)

23795. "Frequency changer systems for multi-range wireless receiving apparatus." Marconi's Wireless Telegraph Co., Ltd., August 31st, 1935. (481020.)

23798. "Electric resistance welding." Soudure Electrique. August 30th, 1935. (480791.)

23857. "Electro-magnetically operated switches." A. Cianchi. August 31st, 1936. (481022.)

23893. "Electrically operated vacuum-cleaners." S. H. Smith and C. H. Smith. September 1st, 1936. (480959.)

23930. "Röntgen-ray apparatus." Standard Telephones and Cables, Ltd., and F. N. Scaife. September 1st, 1936. (480864.)

23955. "Electro-magnetic power transmission." Cleaver Magnetic Transmission Co., Inc. September 6th, 1935. (481157.)

23976. "Electron-discharge tubes." Ferranti, Ltd., and M. K. Taylor. September 2nd, 1936. (480867.)

24204. "Electrical condensers." Mallory Patent Holding Co., Ltd. December 20th, 1935. (481114.)

24262. "Magnetically operated electric switches." H. Bright and A. F. W. Richards. September 4th, 1936. (481122.)

24332. "Electric cables." S. A. Pollock. September 5th, 1936. (481125.)

24394. "Television receiving systems." Telefunken Ges. für Drahtlose Telegraphie. September 7th, 1935. (481132.)

24402. "Toy telephone device." L. Marx & Co., Ltd. (L. Marx & Co., Inc.). September 7th, 1936. (480796.)

24404. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. September 6th, 1935. (Cognate application 24405/36.) (481170.)

24648. "Electrical accumulator." L. Jasper. September 9th, 1936. (481032.)

26381. "Short-wave adaptor for wireless receivers." T. A. Biddington and R. Pearl. September 29th, 1936. (480970.)

27848. "Electrical heating appliances." S. D. Hill. October 14th, 1936. (480806.)

28392. "Electrical fuses of the rewirable type." J. A. Crabtree & Co., H. F. McLoughlin and B. G. Harrison. October 19th, 1936. (480887.)

30396. "Means for adjusting electric lamps." Chance Bros. & Co., Ltd., and W. M. Hampton. November 7th, 1936. (480811).

33115. "Electrical sharpening device for razor blades." B. Mietner and Brevita Soc. Anon. December 2nd, 1936. (481039.)

33312. "Electrolytic processes for the manufacture of the alkali earth metals." D. Gardner. December 4th, 1936. (481040.)

33637. "Electric-fan apparatus." L. E. Smith and W. Arbenz. December 8th, 1936. (Cognate application 32758/37.) (481041.)

33674. "Cooling arrangements for electric-discharge lamps." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. December 8th, 1936. (480979.)

34443. "Electric switches for controlling the extent of travel of electric motors." Fairey Aviation Co., Ltd., and A. G. Forsyth. December 15th, 1936. (480983.)

35293. "Variable attenuators for electric transmission systems and the like." General Electric Co., Ltd., and L. I. Farren. December 23rd, 1936. (481043.)

1937

1585. "Thermal switches of safety devices for use on low voltage circuits." Landis & Gyr Akt.-Ges. March 14th, 1936. (480821.)

2933. "Receivers for signals conveyed by electrical carriers of very high frequency." General Electric Co., Ltd., and E. C. S. Megaw. February 1st, 1937. (480992.)

4256. "Electric amplifiers." General Electric Co., Ltd., and K. A. Macfadyen. February 12th, 1937. (480994.)

5012. "Electro-optical image-transmission systems." Electrical Research Products, Inc. March 4th, 1936. (480996.)

5425. "Scanning discs for television." General Electric Co., Ltd., D. C. Espley, H. W. B. Gardiner and W. O. Russell. February 23rd, 1937. (480997.)

5829. "Protective and safety arrangements for high-voltage output circuits of transformers." H. Williams, and Maple & Co., Ltd. February 26th, 1937. (480828.)

6383. "Means for reducing high-frequency disturbances in high-frequency receiving apparatus." E. Huber. March 23rd, 1936. (481001.)

6716. "X-ray apparatus." E. J. Ries. March 6th, 1937. (481002.)

7056. "Electric cable systems." Okonite-Callender Cable Co., Inc. December 7th, 1935. (Divided out of 478850.) (480829.)

7313. "Screw caps for electric lamps and electric-discharge vessels." General Electric Co., Ltd., M. Pirani and C. J. Smithells. March 12th, 1937. (481047.)

9295. "Portable electric current transformers." E. Reich, and General Electric Co., Ltd. April 9th, 1936. (481052.)

9919. "Electric controlling devices and circuits therefor." Etablissements Edoux-Samain Soc. Anon. April 8th, 1936. (481054.)

12430. "Tuning arrangements for oscillatory electric circuits." L. L. de Kramolin. August 29th, 1936. (Divided out of 479949.) (Cognate application 23736/36.) (481062.)

12565. "Gas-filled electric incandescent lamp." Vereinigte Glühlampen und Elektrizitäts Akt.-Ges. September 12th, 1936. (481063.)

12849. "Demodulating circuit arrangements for phase-modulated waves." Marconi's Wireless Telegraph Co., Ltd. May 5th, 1936. (481064.)

13697. "Carrier-wave receiving systems." Standard Telephones & Cables, Ltd. July 9th, 1936. (480839.)

13809. "Armatures of dynamo-electric machines." Black and Decker Manufacturing Co. May 23rd, 1936. (480840.)

16106. "Electrical hand vibrators." C. G. E. Cahier. June 10th, 1937. (480842.)

16149. "Electric-discharge devices." British Thomson-Houston Co., Ltd. June 11th, 1936. (481071.)

16750. "Electric plugs containing safety fuses." J. Petersen. June 16th, 1937. (481073.)

17754. "Electric lamp sockets for supporting a bulb within a vehicle lamp." P. Leo. June 25th, 1937. (481075.)

18228. "Self-baking electrodes for electric furnaces." Norske Aktieselskab for Elektrokemisk Industri. July 8th, 1936. (481010.)

19644. "Vapour electric-discharge devices." British Thomson-Houston Co., Ltd. July 16th, 1936. (481078.)

20089. "Suppressed carrier-wave signalling systems." Telefunken Ges. für Drahtlose Telegraphie. July 20th, 1936. (480847.)

20798. "Permanent magnet systems, more particularly for electricity meters." Siemens-Schuckertwerke Akt.-Ges. August 6th, 1936. (Addition to 441526.) (481149.)

21649. "Measuring apparatus for high-frequency currents." Siemens and Halske Akt.-Ges. August 6, 1936. (481081.)

22327. "Two-wire-four-wire combinations in electric signalling systems." Siemens and Halske Akt.-Ges. August 13th, 1936. (481085.)

23425. "Electron-discharge tube arrangements." Marconi's Wireless Telegraph Co., Ltd. September 19th, 1936. (481086.)

23773. "Electro-dynamic relay for the protection of electrical installations." Landis and Gyr Akt.-Ges. September 9th, 1936. (481152.)

24154. "Ultra-short wave devices." C. Lorenz Akt.-Ges. September 5th, 1936. (481153.)

31201. "Electric cut-outs, connectors, and the like." E. T. G. Donovan. November 13th, 1937. (480851.)

1938

2185. "Devices utilising secondary electron emission." British Thomson-Houston Co., Ltd., and D. Gabor. May 27th, 1936. (Divided out of 480786.) (481012.)

2594. "Systems of and apparatus for television." W. H. Priess. July 13th, 1935. (Divided out of 480673.) (480944.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 23rd.

Radio. No. 579762. Class 6. Electrically operated shaving machines and parts thereof.—Ever Ready Razor Products, Ltd., Ever Ready Corner, The Hyde, Hendon, N.W.9.

Tortoise (design only). No. 579823. Class 6. Electrically operated turntables and electric motors and parts thereof. No. 579824. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Makers' Agents, Ltd., 52, High Holborn, W.C.1.

Tortoise (lettering only). No. 579825. Class 8. Sound amplifying apparatus, electric transformers, charging apparatus for electric accumulators, microphones, earphones for use in wireless telegraphy and telephony, and instruments for determining by electric impulses, sound frequencies and synchronous and mechanical errors.—Makers' Agents, Ltd., address as above.

Telefunken (lettering and design). No. 583633. All goods in Class 8.—Telefunken Gesellschaft für Drahtlose Telegraphie, Berlin, S.W.11. (British representatives, Baron & Warren, Thanet House, 231, Strand, W.C.2.)

Mirad. No. 581880. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Harry Williamson, 240, Willesden Lane, Brondesbury, N.W.2.

Distrene. No. 578655. Class 40. Thermosetting and thermoplastic moulding compositions, made mainly of indiarubber, and sold in rods, blocks, sheets or shaped pieces.—Honeywill & Stein, Ltd., 15, Regent Street, S.W.1.

Telefing. No. 583002. Class 50. Hand-operated devices to be used in lieu of the finger for operating automatic telephone dials, made of wood, bone, or synthetic resin.—Ernest Ephraimson, 4, Adamson Road, N.W.3.

The "Civils" Membership

The new list of members of the Institution of Civil Engineers, corrected to January 25th, 1938, contains a total of 12,019 names and addresses, including those of 53 associates and of 2,370 students. There is a topographical list of members overseas, while local associations number nine at home and four abroad, apart from the students' association.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Arnside.—Convalescent home (£20,000); H. S. Fairhurst & Son, architects, Chancery Chambers, 56, Brown Street, Manchester.

Ashby-de-la-Zouch.—Houses (19), Westfield Avenue estate, near Burton Road; L. Swanwick, architect, Temple Chambers, Belvoir Road, Coalville.

Ayr.—Ice ring (£50,000), for Ayr Ice-ring, Ltd., 208, Bath Street, Glasgow; secretary.

Bacup.—Houses (98), Cutler Green; borough engineer.

Basford.—Houses (48), Greasley (£19,080); F. Sisson & Sons, Ltd., contractors, Cromford Road, Langley Hill.

Bath.—Fire station (£26,802); borough engineer.

Bathgate.—Houses (120), Cochrane Street (£55,000); A. L. Reid, 32, Hopetoun Street.

Bedford.—Houses (86), London Road and Goldington housing estates; borough surveyor.

Bingley.—Extensions to Bingley Hospital (£23,000), for Extensions Committee; W. Potter, architect, Manor estate, Cottingley.

Birmingham.—Additions to Shawbury school (£10,750), Shutstoke; E.C.

Blackpool.—Theatre, Dickson Road, for Odeon Theatres, Ltd.; P. Hamer, Ltd., contractors, Park Street, Swinton.

Boldon.—Houses (124); George Thornton, Ltd., builders, South Shields.

Braintree.—Houses (82), Panfield Lane; U.D.C. surveyor.

Bromsgrove.—Houses (99), Perryfields estate; U.D.C.

Bucknall.—Houses (600), for Stoke-on-Trent Corporation, New House Farm estate (£290,372); E. Johnson, Ltd.

Bury.—Offices, Upper New Road, Heap Bridge, for Yates Duxbury, Ltd., Heap Bridge; Bradshaw Gass & Hope, architects, 19, Silverwell Street, Bolton.

Caernarvon.—Houses (80), Ysgubor Goch (£30,660), for T.C.; Williams & Williams, contractors.

Chesterfield.—Houses (130), Eckington (£46,692); W. Drabble & Sons, builders, Mosborough.

Cumberland.—School, Silloth; county architect, 4, Alfred Street North, Carlisle.

Co. Durham.—School, Blackhall Colliery; county architect, 34, Old Elvet, Durham.

Ealing.—Houses (18), Delamore Road; Bloomfield Building Co., Ltd., Warwick Dene estate, Ealing Common, London, W.5. Houses (300), Medlar Farm estate; C. W. & W. Harding, Ltd., Heights Avenue, Greenford. Houses (50), Ruislip Road; Clayton Farm Estates, Ltd., Bridge Road, Isleworth. Store premises, for Marks & Spencer, Ltd.; W. A. Lewis & Partners, architects, 130, Regent Street, W.1.

Easington.—Houses (170), for the R.D.C.; architect.

Falkirk.—Cinema, for Odeon Cinema Co. (£25,000); secretary. Extensions to linoleum factory (£12,000), for Scottish Co-operative Wholesale Society, Ltd., Morrison Street, Edinburgh.

Gateshead.—Factory, for Messrs. Crake; Stephen Easten, contractors, Milburn House, Newcastle-on-Tyne.

Glasgow.—Cinema, 114, Main Street, for Odeon (Bridgeton), Ltd.; A. Mather, architect, 102, Bath Street. Hide and skins factory (£45,000), Gallowgate, for Scottish Co-operative Wholesale Society; Society's architect.

Grangemouth.—Houses (150); burgh surveyor.

Grimsby.—Extensions to library (£29,500); borough engineer.

Gwyrfai.—Houses (86) (£34,366); R.D.C. surveyor.

Hale.—Houses (80), Carr Wood estate; James Crosby & Sons, Ltd., Carr Wood, Hale.

Hamsteels (Co. Durham).—Houses (50), for North-Eastern Housing Association, Metrovick House, Newcastle-on-Tyne; E. Simpkins, Council Offices, Lanchester.

Hanley.—Offices and shops, Stafford Street and Cheapside; Cardigan Estates, Ltd.

Hetton-le-Hole.—Houses (36); G. McCall, builder, New Herrington.

High Wycombe.—Houses (38), near Cressex Lane; D. Moss.

Hornchurch.—Houses (40), Ingrebourne Road (£15,524), for U.D.C.; Cripps Bros., Ltd., builders, Rochford.

Ilford.—Houses (27), Marlands Road; T. Anders, 100, High Road.

Ipswich.—Rebuilding Rose Hill school (£14,596); A. S. Green.

Irvine.—Extensions to works, for Ayrshire Dockyard Co.

Lancashire.—School, Brierfield (£29,867), for the C.C.; J. Turner & Sons (Preston), Ltd., contractors, William Henry Street, Preston.

Lincoln.—Houses (178), Moorland Avenue and Goldsmith Walk; Walters & Westley, Ltd., contractors, Springfield Road, Sheffield.

London.—(Battersea).—Tenements, Savonna Street (£30,165); R. J. Rowley, Ltd., Belmont Works, Belmont Avenue, N.17. (Bermondsey).—Flats (60), Fair Street (£40,837); borough engineer. (Deptford).—Flats (44), Frankham Road (£28,600); L.C.C. architect, County Hall, Westminster Bridge, S.E.1. (Hammersmith).—Block of offices, Queen Street; L. O. Woodward, Bridgeway House, W.6. (Poplar).—Block of offices, 41-7, Bow Road; R. S. Andrews, 135, Bow Road, E.3. (St. Pancras).—Baths, Camden Road (£84,500); borough engineer. Rebuilding Acland central school (£31,695), and extensions to hospital (£38,000); L.C.C. architect. (Southwark).—Houses, Zoar Street area (£32,000), and flats, Mermaid Court (£44,000); L.C.C. architect. (Woolwich).—School, Montbello Road (£32,000); L.C.C. architect.

Manchester.—Flats, Collyhurst (£60,000); L. Heywood, housing director.

Middlesbrough.—Houses (100), Bramble estate; borough engineer. Houses (12), Kestrel Avenue; T. Young, builder, Coast Road, Redcar. Houses (20), Westminster Road, &c., for A. Cubitt; F. Jackson, architect, Queen's Square.

Middleton.—Houses (214), Acresfield Road, &c.; Pine Estates, Ltd., Snipe estate, Audenshaw.

Milnrow.—Houses (192), Heatley Knole, Fir Grove; F. Annable, 73, Hyde Road, West Gorton, Manchester.

Newbiggin.—Houses (36); J. Kailofer, U.D.C. surveyor.

Newcastle-on-Tyne.—Factory for Messrs. J. Heron, timber merchants, Skinnerburn; The Alnwick Construction Co., Ltd., contractors, Northumberland. Factory for Quin & Son, Westgate Road; C. S. Errington, architect, 46, Grainger Street.

Newport (Mon).—Police court, &c. (£89,424); borough engineer.

Northwich.—Houses (118), Mayfield, Danefield and Alfred Street sites; U.D.C. surveyor.

Oldham.—Houses (30), Glodwick Market site; borough surveyor.

Olton (Warwickshire).—Houses (1,500), for the Ideal Benefit Society, Pitmaston, Birmingham; Beard, Bennett & Cooper, 117, Corporation Street, Birmingham.

Patcham.—Houses (46), Hollingbury Copse estate; Sussex Property and Building Co., Ltd.

Peterborough.—Extensions to Peterborough and District Hospital (£50,000); A. W. Ruddle, architect, Long Causeway.

Pontypool.—Houses (28); A. Langley, architect, Midland Bank Chambers.

Portsmouth.—Extensions to Portsmouth Cathedral (£30,000); Sir Charles Nicholson, architect.

Prudhoe-on-Tyne.—Houses (66); H. Kindred, builder, Westacres, Newcastle-on-Tyne.

Pwilheli.—Houses (58), Morfa Garreg; borough surveyor.

Ripon.—Houses (20) for the City Council; city engineer.

Rotherham.—Houses (106) and shops, near Wellgate; V. Dunk & Co., Ltd., Oakwood Road.

Rugby.—Houses (36), Wolston and Frankton; R.D.C. surveyor.

Saltcoats.—Premises, Hamilton Street, for Clydesdale Bank, Ltd.

Sheffield.—School, Lindsay Road, Parson Cross, for the E.C.; city architect.

Southampton.—Factory and stores, Dock estate, for General Motors, Ltd.; Sir Robert McAlpine & Sons, Ltd., contractors, 50, Pall Mall, London, S.W.1.

Stirling.—Extensions to business premises, Murray Place (£25,000), for Montague Burton, Ltd., Leeds.

Stranraer.—Houses (78), Dicks Hill area; burgh surveyor.

Swansea.—Houses (140), Fforestfach area; borough architect.

Swinton.—Houses (130), Croft, Knowles Gate, Gate Street and Dorning Street; borough surveyor. Houses (31), Entwistle Street, Moss Lane, Charles Street, and Hamilton Street; W. Davies, builder.

Tiverton.—Omnibus depot and garage, Lodge Road, for Devon General Omnibus and Touring Co., Ltd.; H. Pincott & Sons, contractors, 25, Gold Street.

Towcester.—Houses (32), Potterspury; R.D.C. surveyor.

Tunstall.—Houses, Chell Heath estate (£586,845); C. & J. Seddon, Ltd.

Tynemouth.—Houses (214), Ridge estate (£61,396); James Carruthers & Sons, contractors, Percy Square, North Shields.

Warwickshire.—School, Union Road, Shirley, for the C.C.; county architect.

Whitby.—Houses (96), St. Peter's Road estate; engineer and surveyor, Council Offices.

Widnes.—Houses (60), Hole Bank estate; borough surveyor.

Wigtown.—Houses (200), for C.C.; R. G. Logan, Education Offices, Stranraer.

Willenhall.—Houses (26), Dilloways Lane; J. V. Senior, Hadley House, Bilston. Houses (28), Noose Lane; Shellabear Price, Ltd., 47, Victoria Street, Westminster, London, S.W.1.

Writtle.—Agricultural college, comprising institute, hostels, dairy, houses, &c., for Essex Agricultural Committee; county architect, County Hall, Chelmsford.

Yorkshire.—School, Kirk Sandall, for the West Riding E.C.; county architect, County Hall, Wakefield.

North Wales Engineers' Dinner

THE North Wales Electrical and Communication Engineers held their seventh annual dinner at the Queen Hotel, Chester, on March 26th under the chairmanship of Mr. H. Faulkner, M.I.E.E., superintendent engineer of the North Wales District, Post Office Engineering Department. Mr. W. Fennell, general manager and engineer to the Mid-Cheshire Electricity Supply Co., Ltd., in proposing "The Post Office Engineering Department," reminded those present that this annual gathering of Post Office and supply engineers was unique and had greatly improved the relations between them. Mr. Faulkner, in responding, endorsed what the proposer had said. Mr. J. H. Watkins (Post Office Engineering Department, Shrewsbury), in proposing "The Electrical Industry," embracing the supply industry together with manufacturing and contracting, referred to the rapid developments which were taking place. Mr. Alan Thwaites (North Wales Power Co.), replying, indicated that the supply and the coal mining industries shared the doubtful honour of being subject to a greater measure of legislation than any other. The latter had just received its latest dose, and the supply industry was apparently "for it" in the coming autumn. Mr. Price White (electrical and gas manager to the Bangor Corporation) proposed "Our Guests," which was responded to both by Alderman Smith, of Conway, and Col. Cortez Leigh. During the evening Mr. T. K. Fell gave some topical songs at the piano, one of which dealt in a flippant manner with the McGowan Report as viewed by certain persons present.